SPECIAL PROVISIONS

BASE BID ITEM 1 – MOBILIZATION/DEMOBILIZATION

Work Description:

This Bid Item includes the preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the site; for the establishment of all facilities necessary for work on the project; and for all other work and operations which must be performed, or costs incurred prior to beginning work, on the various items on the project site. Mobilization includes obtaining any permits not provided by the Contracting Officer, and obtaining project-specific bonds.

This Bid Item also includes preparatory work and operations necessary for maintaining existing access routes, staging areas and temporary haul roads, and constructing temporary haul roads and staging areas. This Bid Item also includes preparatory work and operations necessary for site maintenance, environmental controls and reclamation of disturbed areas.

Contractor shall provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01505 Mobilization/Demobilization
Section 01560 Environmental Controls
Section 01600 Protection of Materials
Section 01640 Government Supplied Materials
Section 01720 Record Drawings
Section 02140 Dewatering and Work Area Isolation
Section 02160 Site Preparation
Section 02900 Seeding

Applicable Drawings:

1.0 Cover Page and Notes
2.0 Existing Conditions
3.0 Site Plan
4.0 Access, Staging and Utilities
4.1 Work Area Isolation and Erosion Control

Measurement and Payment:

Measurement and payment for Bid Item 1 shall be made as follows:

- 25 percent of the lump sum bid price shall be paid when the Contractor has moved equipment on-site, begun construction activities and submitted the required submittals including but not limited to the water management plan, etc.

- 50 percent of the lump sum bid price shall be paid when 25 percent of the contract amount (exclusive of Bid Item 1) has been completed.
- 75 percent of the lump sum bid price shall be paid when 50% of the contract amount (exclusive of Bid Item 1) has been completed.
- 100 percent of the lump sum bid price shall be paid when 75% of the contract amount (exclusive of Bid Item 1) has been completed.

BASE BID ITEM 2 – CONSTRUCT REARING PONDS, PIPING AND CONTROLS

Work Description:

This Bid Item includes the preparatory work and operations necessary for construction of Rearing Ponds 5A, 5B, 6A, 6B; pond geosynthetic clay liners; liner fill; pond inlet piping from the water distribution manifold; pond outlet piping to the stilling basin; four armored pond inlet channels; four armored pond spillways; four concrete kettle drains; four water control structures; and a concrete stilling basin/fish barrier structure. Contractor shall provide all labor, tools, equipment, earthwork, materials, and incidentals necessary to complete the Work as specified.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01400 Construction Staking
Section 01560 Environmental Controls
Section 01600 Protection of Materials
Section 02140 Dewatering and Work Area Isolation
Section 02160 Site Preparation
Section 02200 Earthwork
Section 02410 Geosynthetic Clay Liner
Section 03100 Concrete Formwork
Section 03210 Reinforcing Steel
Section 03300 Cast In Place Concrete
Section 04100 Pipe Installation
Section 04200 Pipe Materials and Fittings
Section 05001 Channel and Floodplain Fill

Applicable Drawings:

4.1 Work Area Isolation and Erosion Control
4.2 Grading Plan
5.0 Rearing Ponds 5A and 5B Plan and Profile
5.1 Rearing Ponds 6A and 6B Plan and Profile
5.2 Rearing Ponds 5A and 5B Cross Sections
5.3 Rearing Ponds 6A and 6B Cross Sections
5.4 Kettle Drain Details
5.5 Water Control Structure Details
5.6 Stilling Basin and Fish Barrier Details

Measurement:

Measurement for Bid Item 2 shall be by lump sum in accordance with the Contract Documents as determined by the Contracting Officer's Representative**.**

Payment:

Payment for Bid Item 2 shall be made according to the lump sum bid price in the Contract Documents.

BASE BID ITEM 3 – INSTALL INFILTRATION GALLERY AND PIPING

Work Description:

This Bid Item includes the preparatory work and operations necessary for construction of the Reach 2 infiltration gallery; installation of piping to the water distribution manifold; grading an overflow channel, and installing a new culvert from the overflow channel to the Pond 3/4 Wetland.

Contractor shall provide all labor, tools, equipment, earthwork, materials, and incidentals necessary to complete the Work as specified.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01400 Construction Staking
Section 01560 Environmental Controls
Section 01600 Protection of Materials
Section 02140 Dewatering and Work Area Isolation
Section 02160 Site Preparation
Section 02200 Earthwork
Section 04100 Pipe Installation
Section 04200 Pipe Materials and Fittings
Section 05001 Channel and Floodplain Fill

Applicable Drawings:

4.1 Work Area Isolation and Erosion Control
6.0 Infiltration Gallery and Water Distribution Manifold Plan and Profile
6.1 Infiltration Gallery Details

Measurement:

Measurement for Bid Item 3 shall be by lump sum in accordance with the Contract Documents as determined by the Contracting Officer's Representative**.**

Payment:

Payment for Bid Item 3 shall be made according to the lump sum bid price in the Contract Documents.

BASE BID ITEM 4 – INSTALL WATER DISTRIBUTION MANIFOLD AND PIPING

Work Description:

This Bid Item includes the preparatory work and operations necessary for construction of the water distribution manifold; installation of piping to the Reach 4 existing manhole; installation of piping to the Pond 3/4 Wetland, installation of seven valves; and connections to the infiltration gallery piping, Reach 4 piping, Pond 3/4 Wetland piping, and the four rearing ponds inlets.

Contractor shall provide all labor, tools, equipment, earthwork, materials, and incidentals necessary to complete the Work as specified.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01400 Construction Staking
Section 01560 Environmental Controls
Section 01600 Protection of Materials
Section 02140 Dewatering and Work Area Isolation
Section 02160 Site Preparation
Section 02200 Earthwork
Section 04100 Pipe Installation
Section 04200 Pipe Materials and Fittings
Section 03100 Concrete Formwork
Section 03210 Reinforcing Steel
Section 03300 Cast In Place Concrete
Section 05001 Channel and Floodplain Fill

Applicable Drawings:

4.1 Work Area Isolation and Erosion Control
6.0 Infiltration Gallery and Water Distribution Manifold Plan and Profile
6.2 Water Distribution Manifold Details

Measurement:

Measurement for Bid Item 4 shall be by lump sum in accordance with the Contract Documents as determined by the Contracting Officer's Representative**.**

Payment:

Payment for Bid Item 4 shall be made according to the lump sum bid price in the Contract Documents.

BASE BID ITEM 5 – INSTALL REACH 4 STEP POOLS

Work Description:

This Bid Item includes the preparatory work and operations necessary for construction of the roughened channel and rock step pools in the existing Reach 4 channel.

Contractor shall provide all labor, tools, equipment, earthwork, materials, and incidentals necessary to complete the Work as specified.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01400 Construction Staking
Section 01560 Environmental Controls
Section 01600 Protection of Materials
Section 02140 Dewatering and Work Area Isolation
Section 02160 Site Preparation
Section 02200 Earthwork
Section 05001 Channel and Floodplain Fill

Applicable Drawings:

4.1 Work Area Isolation and Erosion Control
7.0 Reach 4 Plan and Profile
7.1 Step Pool Detail

Measurement:

Measurement for Bid Item 5 shall be by lump sum in accordance with the Contract Documents as determined by the Contracting Officer's Representative**.**

Payment:

Payment for Bid Item 5 shall be made according to the lump sum bid price in the Contract Documents.

BASE BID ITEM 6 – CONSTRUCT REACH 3 CHANNEL

Work Description:

This Bid Item includes the preparatory work and operations necessary for construction of the Reach 3 channel; salvaging and transplanting sod and woody vegetation to the channel banks from locations on the project site; placement of 20 pieces of government supplied large woody debris in the channel banks; grading connections to the Rearing Pond outlet channel; and seeding disturbed areas.

Contractor shall provide all labor, tools, equipment, earthwork, materials, and incidentals necessary to complete the Work as specified. Sod, woody debris and vegetation are government supplied and are available on site.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01400 Construction Staking
Section 01560 Environmental Controls
Section 01600 Protection of Materials
Section 01640 Government Supplied Materials
Section 02140 Dewatering and Work Area Isolation
Section 02160 Site Preparation
Section 02200 Earthwork
Section 02900 Seeding
Section 02931 Vegetation Salvage
Section 02932 Tree Salvage
Section 05001 Channel and Floodplain Fill

Applicable Drawings:

4.1 Work Area Isolation and Erosion Control
4.2 Grading Plan
9.0 Alternate Item Reach 3 Plan and Profile
9.1 Alternate Item Reach 3 Details
9.2 Reach 3 Cross Sections

Measurement:

Measurement for Bid Item 6 shall be by lump sum in accordance with the Contract Documents as determined by the Contracting Officer's Representative**.**

Payment:

Payment for Bid Item 6 shall be made according to the lump sum bid price in the Contract Documents.

BASE BID ITEM 7 – CONSTRUCT POND 8 IMPROVEMENTS

Work Description:

This Bid Item includes the preparatory work and operations necessary for modification of the Pond 8 outlet structure; construction of a roughened step pool channel between the Pond 8 inflow and Reach 3; and construction of a berm between the step pool channel and Pond 8.

Contractor shall provide all labor, tools, equipment, earthwork, materials, and incidentals necessary to complete the Work as specified.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01560 Environmental Controls
Section 02140 Dewatering and Work Area Isolation

Applicable Drawings:

4.1 Work Area Isolation and Erosion Control
7.1 Step Pool Details
10.0 Alternate Item Pond 8 Site Plan

Measurement:

Measurement for Bid Item 7 shall be by lump sum in accordance with the Contract Documents as determined by the Contracting Officer's Representative**.**

Payment:

Payment for Bid Item 7 shall be made according to the lump sum bid price in the Contract Documents.

BASE BID ITEM 8 – CONSTRUCT POND 3/4 WETLAND IMPROVEMENTS

Work Description:

This Bid Item includes the preparatory work and operations necessary for excavating berms; hauling excess fill material to an off-site repository; and seeding disturbed areas.

Contractor shall provide all labor, tools, equipment, earthwork, materials, and incidentals necessary to complete the Work as specified.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01400 Construction Staking
Section 01560 Environmental Controls
Section 02140 Dewatering and Work Area Isolation
Section 02160 Site Preparation
Section 02200 Earthwork
Section 02900 Seeding

Applicable Drawings:

4.1 Work Area Isolation and Erosion Control
11.0 Alternate Item Wetland 3/4 Site Plan

Measurement:

Measurement for Bid Item 8 shall be by lump sum in accordance with the Contract Documents as determined by the Contracting Officer's Representative**.**

Payment:

Payment for Bid Item 8 shall be made according to the lump sum bid price in the Contract Documents.

BASE BID ITEM 9 – INSTALL FENCING AND GATES

Work Description:

This Bid Item includes the preparatory work and operations necessary for installing a fence around the rearing ponds; installing one vehicle access gate; and installing two pedestrian access gates.

Contractor shall provide all labor, tools, equipment, earthwork, materials, and incidentals necessary to complete the Work as specified.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01400 Construction Staking
Section 01560 Environmental Controls
Section 02920 Fence

Applicable Drawings:

5.0 Rearing Ponds 5A and 5B Plan and Profile
5.1 Rearing Ponds 6A and 6B Plan and Profile
5.7 Fencing Detail

Measurement:

Measurement for Bid Item 9 shall be by linear feet in accordance with the Contract Documents as determined by the Contracting Officer's Representative**.**

Payment:

Payment for Bid Item 9 shall be made according to the unit bid price in the Contract Documents.

BID ITEM 10 – INSTALL POND LINER AGGREGATE CUSHION WITH ROCK

Work Description:

This Bid Item includes the preparatory work and operations necessary for installing a six inch thick aggregate cushion of 4 to 6-inch angular rock over the pond liner. The aggregate cushion shall cover the entire bottom of the pond up to the pond crest, excluding the area of the armored pond inlet channels and pond spillways. Means shall be used to place the aggregate cushion such that placement does not disturb or damage the geomembrane liner or liner fill.

Contractor shall provide all labor, tools, equipment, earthwork, materials, and incidentals necessary to complete the Work as specified.

Applicable Technical Specifications:

Section 01300 Submittals
Section 01560 Environmental Controls
Section 02200 Earthwork
Section 02410 Geosynthetic Clay Liner
Section 05001 Channel and Floodplain Fill

Applicable Drawings:

5.0 Rearing Ponds 5A and 5B Plan and Profile
5.1 Rearing Ponds 6A and 6B Plan and Profile

Measurement:

Measurement for Bid Item 10 shall be by square yards in accordance with the Contract Documents as determined by the Contracting Officer's Representative**.**

Payment:

Payment for Bid Item 10 shall be made according to the unit bid price in the Contract Documents.

LIST OF TECHNICAL SPECIFICATIONS

SECTION 01300

SUBMITTALS

PART 1 – GENERAL

1.1 SCOPE

Submittals covered by these requirements include manufacturers' information, test procedures, test results, samples, requests for substitutions, and miscellaneous work-related submittals. Submittals shall also include, but not be limited to, rock sources, fabric sources, and fabricated items. The Contractor shall furnish all drawings, specifications, descriptive data, certificates, samples, tests, methods, and schedules and other instructions as specifically required in the contract documents to demonstrate fully that the materials and equipment to be furnished and the methods of work comply with the provisions and intent of the contract documents.

1.2 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the specified requirements. Submittal documents shall be clearly edited to indicate only those items which are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that here is no conflict with other submittals and notify the Contracting Officer's Representative in each case where his submittal may affect the work of another contractor. The Contractor shall coordinate submittals among his subcontractors and suppliers including those submittals complying with unit responsibility requirements specified in applicable technical sections.

The Contractor shall coordinate submittals with the work so that work will not be delayed. The Contractor shall coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with another. No extension of time will be allowed because of failure to properly schedule submittals. The Contractor shall not proceed with work related to a submittal until the submittal process is complete. This requires that submittals for review and comment shall be returned to the Contractor stamped "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

The Contractor shall certify on each submittal document that he has reviewed the submittal, verified field conditions, and complied with the contract documents.

The Contractor may authorize in writing a material or equipment supplier to deal directly with the Contracting Officer's Representative with regard to a submittal. These dealings shall be limited to contract interpretations to clarify and expedite the work.

1.3 STANDARD COMPLIANCE

A. When materials or equipment must conform to the standards of organizations such as, but not limited to, the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL) documents showing, or proving, conformance shall be submitted.

B. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual Sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable tests, and is approved by the Contracting Officer's Representative. The certificate shall state that the item has been tested in accordance with the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval. The certificate shall identify the manufacturer, the product, and the referenced standard and shall state that the manufacturer certifies that the product conforms to all requirements of the project Specification and of the referenced standards listed.

1.4 REVIEW OF CONTRACTOR'S INFORMATION

A. When review and checking for acceptance is required of any drawing, or information regarding materials and equipment, the Contractor shall prepare or secure, and submit for review, two (2) copies. The Contracting Officer's Representative, after taking appropriate action, will return (1) marked copies to the Contractor.

Within 7 calendar days after receipt of said submittal copies, the Contracting Officer's Representative will return the marked copies indicating one of the following four (4) actions:

1. If review and checking indicates no exceptions, copies will be returned marked "NO EXCEPTIONS TAKEN" and work may begin immediately on incorporating the material and equipment covered by the submittal into the work.

2. If review and checking indicates limited corrections are required, copies will be returned marked "MAKE CORRECTIONS NOTED". Work may begin immediately on incorporating into the work the material and equipment covered by the corrected submittal.

3. If review and checking indicates insufficient, or incorrect data, has been submitted, copies will be returned marked, "AMEND AND RESUMIT". No work may begin on incorporating the material and equipment covered by

this submittal into the work until the submittal is revised, resubmitted, and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".

4. If review and checking indicates the material and equipment submittal is unacceptable, copies will be returned marked "REJECTED-RESUBMIT". No work may begin on incorporating the material and equipment into the work until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".

B. Approval by the Contracting Officer's Representative shall not relieve Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with requirements of this Contract.

1.5 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of his responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Contracting Officer's Representative or the Contracting Officer, or by any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed. A mark of "NO EXCEPTIONS TAKEN or MAKE CORRECTIONS NOTED" shall mean that the Contracting Officer has no objection to the Contractor, upon his own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

PART 2 – PRODUCTS

2.1 MANUFACTURER'S DATA

Submittals for each manufactured item shall be comprised of manufacturer's descriptive literature, drawings, diagrams, performance and characteristic curves, and catalog cuts. Manufacturer's name, trade name, model or catalog number, nameplate data, size, layout dimensions, capacity, project specification references, and any other additional information necessary to establish contract compliance shall be clearly indicated.

PART 3 – EXECUTION

3.1 SUBMITTAL PROCEDURE

A. At least 7 calendar days prior to the Contractors need for approval, contractor shall forward to the Contracting Officer's Representative all submittals required by the individual Sections of the Specifications.

B. All submittals shall be identified by submittal number and specification section number on the letter of transmittal. Submittals shall be numbered consecutively and resubmittals shall have a letter suffix. For example:

1. 1st submittal: 2
2. 1st submittal: 2A
3. 2nd resubmittal: 2B, *etc*.

3.2 CONTRACTOR SUBMITTALS

Items to be submitted are specified in individual Sections of these Specifications. Submittals for each Section shall be bound together in one book. Book shall have numbered tab dividers for each item. Submittals that are related to, or affect, each other shall be forwarded simultaneously as a package to facilitate coordinated review. Uncoordinated submittals will be rejected. Do not combine unrelated materials in the same submittal. Submittals shall be arranged in same order as they appear in the Specification Section. Items shall be clearly marked with the same identification number as indicated on the drawings. The Contractor shall include submittal time appropriate within each item of work on the Construction Schedule. The Contracting Officer's Representative will receive submittals at the preconstruction meeting.

END OF SECTION

SECTION 01400

CONSTRUCTION STAKING

PART 1 – GENERAL

1.1 CONSTRUCTION STAKING

The Contractor shall provide survey staking for construction. The Contracting Officer's Representative will provide survey control points and data files for piping alignments, stream channel alignments and digital terrain models for proposed grading surfaces. Digital terrain models will be suitable for use with equipment having GPS machine control capability. When the Contractor requires horizontal and vertical control the contractor shall notify the Contracting Officer's Representative of this requirement a minimum of three working days in advance of this need.

1.2 STAKEOUT AND MEASUREMENT TO BE PERFORMED BY CONTRACTOR

The Contracting Officer's Representative will provide an initial layout of the restoration design in consultation with the Contractor. After the initial layout, the Contractor shall be responsible for staking reference points/markers to complete the work from the initial control points and grading surfaces provided by the Contracting Officer's Representative, and shall be responsible for all measurements required for the execution of the work. The Contractor shall protect all stakes and shall pay for the time and materials required to replace stakes that have been disturbed or obliterated if necessary.

The Contractor shall stake the construction limits and vegetation preservation areas. The Contracting Officer or Contracting Officer's Representative shall approve staking of construction limits and vegetation preservation areas prior to commencement of work.

The Contractor shall furnish at the Contractor's own expense, such stakes, equipment, tools, materials, and all labor as required in stakeout of any parts of the work from the control points and grading surfaces provided by the Contracting Officer or the Contracting Officer's Representative.

The Contracting Officer's Representative may require that work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking of the work.

END OF SECTION

SECTION 01505

MOBILIZATION AND DEMOBILIZATION

PART 1 – GENERAL

1.1 MOBILIZATION

A. Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the site; for the establishment of all facilities necessary for work on the project; and for all other work and operations which must be performed, or costs incurred prior to beginning work, on the various items on the project site. Mobilization includes obtaining any permits not provided by the Contracting Officer, and obtaining project-specific bonds.

B. Mobilization shall also include the construction of temporary ramps and access ways, temporary roads, grading, temporary fencing, and the necessary preparatory work required to allow for the safe and stable movement of all vehicles that are required to construct the improvements outlined in the Contract Documents.

C. Equipment

1. All equipment shall be washed prior to mobilization to the site to minimize the introduction of foreign materials and fluids to the project site. All equipment shall be free of oil, hydraulic fluid, and diesel fuel leaks. To prevent invasion of noxious weeds or the spread of whirling disease spores, all equipment shall be power washed or cleaned to remove mud and soil prior to mobilization into the project area. It will be the contractor's responsibility to insure that adequate measures have been taken.
2. Equipment shall be in a well-maintained condition to minimize the likelihood of a fluid leak. If a fluid leak does occur, the project inspector shall be notified immediately, and all work ceased until the leak has been rectified. At all times during the construction phase, fluid spill containment equipment shall be present on-site and ready for deployment should an accidental spill occur. Project inspector reserves the right to refuse equipment that does not meet criteria.
3. All construction equipment shall be staged in a location and manner to minimize air, soil and water pollution. Storage of fuel and lubricants - all fuel and lubricants shall be stored in containers and areas that are in conformance with the Idaho State Department of Environmental Quality, biological opinion terms and conditions, and local regulations.
4. Servicing and refueling equipment - all fuel and lubricants used in the servicing of construction equipment shall be done in a manner that avoids spills and over filling and shall be at least 150 feet from all

waterbodies. The Department of Environmental Quality shall be notified immediately of any spill and the operator shall contain the spillage.

5. If a spill of chemical pollutants such as fuel or hydraulic fluid should occur, immediately attempt to contain the spilled material. The following procedures shall be followed:
   (a) for spillage on land, construct earthen berms or use other suitable barricade material of sufficient size to contain the spill and keep it from spreading.
   (b) for spillage on water, attempt to isolate and contain the spilled material. Commercial booms or other suitable materials shall be kept on site during construction to contain fuel and oil spills on water.
6. Sanitary facilities - sanitary facilities such as chemical toilets shall be located at least 150 feet from water bodies to prevent contamination of surface or subsurface water.

1.2 DEMOBILIZATION AND SITE RECLAMATION

A. Demobilization shall consist of work and operations necessary to disband all mobilized items and clean up the site. The removal of all temporary ramps, access ways, roads, signs, temporary fencing, construction debris including rock chips, wood debris, construction stakes, and other construction-related refuse, and temporary facilities or works and the restoration of surfaces to an equal or better than existing condition shall also be included as part of demobilization.

B. Site reclamation is included under demobilization. Site reclamation includes reclamation of areas disturbed during construction, other than access and staging areas, to pre-project conditions or better.

C. All damaged or disturbed streambanks are to be restored to a natural slope pattern and profile for establishment of permanent woody vegetation.

D. All disturbed streambank and wetland vegetation is to be replaced. Use a variety of species native to the project area, region or as specified on project drawings and specifications. Replant or reseed each area requiring re-vegetation before the end of the first planting season following construction.

E. Boulders, rock, woody materials and other natural construction materials used for the project shall be obtained beyond the bankfull elevation and at least 150 feet from any waters of the state, except for native materials obtained from within the project footprint to be stockpiled and reused on site. Leave native materials, e.g., down wood, where they are found, if possible. If native materials (e.g., downed wood) are destroyed, replace them with a functional equivalent during site restoration.

F. Stockpiled materials (i.e. trees, vegetation, sand, topsoil, and other excavated material from restoration project areas) shall be used to rehabilitate areas disturbed by equipment to pre-work conditions. Short-term stabilization measures will be implemented until permanent erosion control measures (plant restoration) are effective, and include seeding of native grass at 20 lbs/per acre

in sunlit areas, use of native grass straw at 2,000 pounds per acre in forested areas, or similar techniques. Reclamation planting shall be completed no later than spring planting season of the year following completion of construction.

1.3 RELATED WORK:

A. Section 01300, Submittals
B. Section 01560, Environmental Controls
C. Section 01600, Protection of Materials
D. Section 02160, Site Preparation
E. Section 02900, Seeding
F. Section 02931, Vegetation Salvage
G. Section 02932, Tree Salvage

PART 2 – PRODUCTS

Materials and product specifications are included on drawings and in related specifications.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01560

ENVIRONMENTAL CONTROLS

PART 1 – GENERAL

1.1 SITE MAINTENANCE

The Contractor shall keep the work site, staging areas, and Contractor's facilities clean and free from rubbish and debris. The Contractor staging area is noted on the drawings. Materials and equipment shall be removed from the site when they are no longer necessary. Equipment removed as part of demolition shall not be stored on site. Upon completion of the work and before final acceptance, the work site shall be cleared of equipment, unused materials, and rubbish to present a clean and neat appearance.

A. CLEAN-UP:

1. Waste material of any kind will not be permitted to remain on the site of the work or on adjacent roads. Immediately upon such materials becoming unfit for use in the work, they shall be collected, carried off the site, and properly disposed of by the Contractor.
2. The Contractor shall provide temporary restroom and cleanup facilities for Contractor's employees and keep these areas clear of all refuse, rubbish, and debris that may accumulate from any source and shall keep them in a neat condition to the satisfaction of the Contracting Officer.
3. In the event that waste material, refuse, debris, and/or rubbish are not so removed from the work by the Contractor, the Contracting Officer reserves the right to have the waste material, refuse, debris, and/or rubbish removed and the expense of the removal and disposal charged to the Contractor.

1.2 AIR POLLUTION CONTROL

The Contractor shall not discharge smoke, dust, and other contaminants into the atmosphere that violate the air pollution regulations for the area. The Contractor shall maintain construction vehicles and equipment in good repair. Exhaust emissions that are determined to be excessive by the Contracting Officer's Representative shall be repaired or replaced. If determined to be necessary by the Project Inspector, Contractor shall provide a water truck to manage project area dust.

1.3 NOISE CONTROL

A. The Contractor shall comply with all local controls and noise level rules, regulations, and ordinances which apply to any work performed pursuant to the Contract. If the requirements of this Section are more restrictive than those of the local regulations, the requirements of this Section shall govern.

B. Each internal combustion engine, used for any purpose related to this Contract, shall be enclosed and be equipped with a muffler of a type recommended by the

manufacturer. No internal combustion engine shall be operated on the project without said muffler and enclosure.

1.4 DEWATERING AND WORK AREA ISOLATION PLAN

A. Before starting work on the project, the Contractor shall submit, for acceptance by the Contracting Officer's Representative, a "Dewatering and Work Area Isolation Plan" as outlined in Section 02140, if required. The plan shall be implemented during construction of the project to control water and aquatic organism access to the project site.

B. The Contractor shall not perform any excavation, or earthwork of any type on the project until a written acceptance of the "Dewatering and Work Area Isolation Plan" has been received from the Contracting Officer's Representative. If in the opinion of the Contracting Officer's Representative, the plan does not sufficiently address the objectives outlined in this Section, the Contractor shall revise the plan accordingly to the satisfaction of the Contracting Officer's Representative.

C. Full compensation for conforming to the requirements of this Section shall be considered as included in the lump sum price paid for the various items of work, and no additional compensation will be allowed therefore.

1.5 EROSION CONTROL

A. A Montana DEQ Stormwater Pollution Prevention Plan for construction activities shall be prepared and carried out by the contractor to prevent pollution related to construction operations. The plan will include:

1. Practices to prevent erosion and sedimentation associated with access roads, stream crossings, construction sites, borrow pit operations, haul roads, equipment and material storage sites, fueling operations and staging areas.
2. A spill containment and control plan with notification procedures, specific clean up and disposal instructions for different products, quick response containment and clean up measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.
3. Practices to prevent construction debris from dropping into any stream or water body, and to remove any material that does drop with a minimum disturbance to the streambed and water quality.

B. Erosion control measures shall be in place prior to commencing construction. During construction, all erosion controls shall be inspected by the contractor daily to ensure they are working adequately.

1. If inspection shows that the erosion controls are ineffective, work crews will be mobilized immediately to make repairs, install replacements, or install additional controls as necessary.
2. Sediment must be removed from erosion controls once it has reached 1/3 of the exposed height of the control.

C. Contractor shall provide measures to prevent movement of soil into waterways or wetlands, e.g. filter bags, sediment traps or catch basins, vegetative strips, berms, jersey barriers, fiber blankets, bonded fiber matrices, geotextiles, mulches or compost, wattles and sediment fences. Biodegradable erosion control products are preferred. Non-biodegradable measures must be removed at final acceptance.

D. Contractor shall provide measures to prevent stockpile erosion during rain events or when the stockpile site is not moved or reshaped for more than 48 hours, by surrounding piles with compost berms, covering piles with impervious materials or other equally effective methods.

E. Contractor shall provide measures to prevent construction vehicles from tracking sediment offsite or onto roadways where it is subject to washing into storm drains, waterways, or wetlands; including gravel access pads, wheel wash stations, or other equally effective methods.

F. Contractor shall install removable pads or mats to prevent soil compaction in all temporary construction access points and staging areas in riparian or wetland areas.

G. Contractor shall prepare and have on-site a spill containment and control plan with notification procedures, equipment, specific cleanup and disposal instructions for all products used on site.

H. Contractor shall have an emergency supply of sediment control materials on hand (silt fence, straw bales, etc.), an oil adsorbing floating boom, and absorbent pads.

I. Stationary power equipment, such as generators, within 150 feet of the water shall be diapered to prevent leaks.

J. All power equipment within 150 feet of the water shall be inspected daily for fluid leaks and repaired. The contractor must keep daily inspection reports in a diary.

END OF SECTION

SECTION 01600

PROTECTION OF MATERIALS

PART 1 – GENERAL

Contractor furnished materials shall be shipped, handled, stored, and installed in ways that will prevent damage to the items. Damaged items will not be permitted as part of the work, except in cases of minor damage that have been satisfactorily repaired and are acceptable to the Contracting Officer's Representative. Government supplied materials supplied by the Contracting Officer shall be protected as contractor furnished materials upon delivery to the project site.

PART 2 – NOT USED

PART 3 – EXECUTION

3.1 DELIVERY OF MATERIAL

The Contracting Officer and Contracting Officer's Representative will not accept material deliveries for the Contractor.

END OF SECTION

SECTION 01640

GOVERNMENT SUPPLIED MATERIALS

PART 1 – GENERAL

Government supplied items and materials will be provided for incorporation into the work. The contractor shall coordinate delivery time, handling, and storage for each material with the Contracting Officer.

PART 2 – PRODUCTS

2.1 The government will provide rock, woody debris and vegetation for salvage/transplant. Government supplied materials are available on site. Rock and woody debris are stockpiled in the staging area in piles of like material. Approximately 10 cubic yards of 6-inch cobble and 2 cubic yards of 2-inch gravel are available for use.

PART 3 – EXECUTION

3.1 DELIVERY OF MATERIAL

The Contracting Officer shall deliver product data, samples, tests, and certificates to the Contractor. The Contractor shall handle products once on-site, including storage and transportation to points of installation. The Contracting Officer's Representative will not accept material deliveries for the Contracting Officer or Contractor.

3.2 PROTECTION OF MATERIALS

Materials supplied by the Contracting Officer shall be protected as contractor furnished materials upon delivery to the project site as per Section 01600.

3.3 CONSTRUCTION DELAY

If government supplied items cause delay in the critical path schedule, the Contractor shall notify the Contracting Officer in writing. Only changes to the critical path shall be considered as evidence for changes in contract time.

END OF SECTION

SECTION 01720

RECORD DRAWINGS

PART 1 – GENERAL

1.1 SCOPE

This section describes requirements for the preparation and maintenance of the project record drawings used to document as-built conditions based on field changes and modifications.

PART 2 – PRODUCTS

2.1 PROJECT RECORD DRAWINGS

The Contractor shall maintain a neatly and accurately marked set of record drawings showing the final locations and layout of all structures, grading, planting and other facilities. Drawings shall be kept current weekly, with all work instructions and change orders; and construction adjustments. Drawings shall be subject to the inspection of the Contracting Officer or Contracting Officer's Representative at all times, and progress payments, or portions thereof, may be withheld if Drawings are not accurate and current. Prior to acceptance of the work, the Contractor shall deliver to the Contracting Officer's Representative one (1) set of neatly marked record drawings, accurately showing all the information required above. The record drawings shall include the final locations and details of the project with changes/modifications clearly marked in red.

END OF SECTON

SECTION 02140

DEWATERING AND WORK AREA ISOLATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope: This section provides performance standards for the dewatering systems and it is intended that the Contractor will provide site specific details as to their proposed way of dewatering the site during construction.

B. The Contractor shall comply with all federal, state, and local laws and regulations concerning environmental pollution arising from construction activities. All permit conditions must also be adhered to by the Contractor.

1.2 SUBMITTALS

Before dewatering is commenced, the Contractor shall obtain the acceptance of the Contracting Officer's Representative for the method, installation, and details of the proposed dewatering system. The Contractor shall submit plans in accordance with Section 01300 (Submittals) setting forth the details of the proposed dewatering systems. The dewatering system plans, at a minimum, shall indicate the following:

A. Sizes of pumps, discharge piping, and piping appurtenances.

B. The personnel responsible for monitoring the dewatering system and dewatered excavations. The contact person must be available at all times or a designated person must be specified in their absence.

C. Provisions to confine fuel and oil spills in the event of their occurrence.

D. Plans to segregate construction water (contaminated with form oils, concrete residues, *etc*.) from clean water.

E. Plans to dispose of the construction water and residue solids.

F. A contingency plan must be provided as part of the approved plan that outlines next steps if the initial plan does not work satisfactorily.

The Contractor's dewatering plan must be approved by the Contracting Officer's Representative, and those provisions in place, prior to in-water excavation.

1.3 QUALITY ASSURANCE

A. The Contracting Officer and Contracting Officer's Representative shall be notified at least 48 hours in advance of commencing dewatering activities.

B. The Contracting Officer's Representative shall be present during initial dewatering.

PART 2 – PRODUCTS

The Contractor shall comply with Section 1.2 Submittals.

PART 3 – EXECUTION

3.1 GENERAL

The Contractor shall furnish, install, operate, and maintain all machinery, appliances, and equipment to maintain all excavations free from moving water during construction, and shall dewater and dispose of the water so as not to cause injury to public or private property, or to cause a nuisance or menace to the public.

The control of groundwater shall be such that softening of the bottom of excavations, or formation of "quick" conditions or "boils," does not occur. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils.

Dewatering systems shall operate continuously until project construction has been completed, or at a minimum, construction within a reach has been completed.

The Contractor shall be fully responsible and liable for all damages, including flotation of structures, which may result from failure to adequately keep excavations dewatered.

3.2 DISPOSAL OF WATER

The Contractor shall dispose of water resulting from the dewatering operation in a suitable manner without damage to adjacent property and in accordance with all federal, state, and local laws and regulations. Sediment-laden water should be discharged to adjacent ground and not allowed to return to the stream until sediments have been removed from the sediment-laden water.

Clean, uncontaminated water resulting from dewatering operations must be returned to the stream.

END OF SECTION

SECTION 02160

SITE PREPARATION

PART 1 – GENERAL

1.1 SCOPE

This section specifies site preparation which consists of clearing, grubbing, and disposal of materials.

1.2 SITE CONDITIONS

A. Existing Conditions

The Contractor shall determine the actual condition of the site as it affects this portion of work.

B. Protection of Existing Facilities

Site preparation shall not damage existing concrete structures, landscaping, fencing, gates, or vegetation adjacent to the areas designated for site preparation. The Contractor shall repair or replace any and all damaged property.

PART 2 – NOT USED

PART 3 – EXECUTION

3.1 CLEARING AND GRUBBING

A. General

All areas comprising the work shall be cleared and grubbed in accordance with the requirements of this section.

B. Clearing and Grubbing

Preservation of existing vegetation and trees is of utmost importance. The Contractor will stake and walk the entire site with the Contractor's Representative to clearly mark the clearing limits and vegetation to be saved or salvaged. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs and all other objectionable material of any kind.

3.2 PROTECTION

The Contractor shall provide protection devices or demarcation of areas outside the project site to be avoided and protected.

3.3 CLEANUP

Debris, rubbish, and excess material resulting from the clearing and grubbing process shall be removed from the site in a manner that will prevent spillage on streets or adjacent areas. Spillage shall be removed from streets and adjacent areas. Federal, State, and local hauling disposal regulations shall be complied with. Cleanup shall be an on-going activity throughout the contract period.

3.4 DISPOSAL OF MATERIALS

All debris, rubbish, and excess material removed during clearing and grubbing work shall become the property of the Contractor and shall be removed from the project site at the Contractor's cost. Contractor shall make his own arrangements for disposing of these materials outside the project site and he shall pay all costs involved. Arrangements shall include, but not be limited to, entering into agreements with property owners and obtaining necessary permits, licenses, and environmental clearances. Burning of materials is allowed on site provided all applicable burning permits are obtained with local, state and federal agencies.

END OF SECTION

SECTION 02180

STRUCTURE REMOVAL

PART 1 - GENERAL

1.1 DESCRIPTION:

This section describes wholly or partially removing reinforced concrete, disposing of the resulting materials, or if required, salvaging and storing designated materials.

1.2 RELATED WORK:

A. Section 02631 CAST IN-PLACE CONCRETE
B. Section 02200, EARTHWORK.
C. Section 01600 PROTECTION OF MATERIALS.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01300, “Submittals”.
B. Submit the following as one package:
    1. Written permits or permission for disposal.

PART 2 – OWNERSHIP AND SALVAGE

2.1 OWNERSHIP OF MATERIALS

Upon removal, culverts, or parts of them, become the property of the contractor, unless designated in the contract as salvageable. If the contractor removes culverts from private property, the contractor must offer these pipes to the property owners before claiming them.

Structures designated to be salvaged shall be carefully removed, disassembled and neatly placed in the storage area shown on the drawings or other selected areas approved by the Contracting Officer’s Representative. All salvaged materials are the property of the Contracting Officer, unless otherwise specified.

2.1 SALVAGE PROVISIONS

Dismantle steel structures or parts of steel structures designated for salvage in a manner that avoids damage to the members. If the contract specifies removing the structure in a manner that leaves it in a condition suitable for re-erection, matchmark all members with durable white paint before dismantling. Mark all pins, bolts, nuts, loose plates, etc., similarly to indicate their proper location. Paint all pins, bolts, pinholes, and machined surfaces with a rust preventative. Securely wire all loose parts to adjacent members, or label and pack them in boxes.

Remove timber structures or parts of timber structures designated for salvage in a manner that prevents damage to the members.

PART 3 - EXECUTION

3.1 CONCRETE CUTTING

At locations where the existing structure is designated to be removed, the existing concrete shall be saw-cut at the neat-lines indicated in the drawings.

3.2 EXCAVATION AND REMOVAL

Excavation and removal shall be governed by Section 02200, Excavation.

3.3 STORAGE AND TRANSPORT

Meausures for “hauling” and “protection of roadways” contained in Section 02200, Excavation, shall also apply to staging and transport of materials for disposal.

3.4 DISPOSAL

Disposal is to conform to all regulations governing solid waste disposal. Obtain written permits for this disposal from the owner of the property where placing the material, unless disposing of the material at a licensed waste disposal operation. Furnish permits, or copies of permits, to the Contracting Officer’s Representative before disposal begins.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, sorting, backfill, grading, hauling, and compaction required to complete the work shown on the drawings, and specified herein. The work shall include, but not necessarily be limited to excavation, backfilling and grading for structures; excavation, backfill and grading for streambanks and channels; salvage, sorting and staging specified categories of substrate; placement of rock materials for channels and structures; placement and mixing of vegetative fill treatments, disposal of surplus and unsuitable materials; and all incidental related work.

1.2 EXCAVATION AND BACKFILL VOLUME ESTIMATES

Excavation quantities reported on the drawings do not include subgrade excavation volumes. Backfill quantities reported on the drawings do not include subgrade excavation volumes and displacement from placement of imported materials

1.3 QUALITY ASSURANCE

A. The Contracting Officer's Representative shall furnish the contractor with computer files representing finished ground surfaces for use by the Contractor's surveyor or for use by equipment with GPS machine control. The contractor is responsible for checking grade to assure grading is in accordance with design surface provided by the Contracting Officer's Representative.
B. The Contracting Officer's Representative shall inspect excavation, backfill, and re-graded surfaces, and will either approve or reject grading based on conformance with design surface, the Drawings, and these specifications.

1.4 RELATED WORK:

A. Section 01300 Submittals
B. Section 02160 Site Preparation
C. Section 05001 Channel and Floodplain Fill

PART 2 – PRODUCTS

Submit compaction test results by independent testing agency in accordance with Section 01300 Submittals.

PART 3 – EXECUTION

3.1 GENERAL

A. Control of Water

The Contractor shall keep excavations free from water during construction.

B. Surplus Material

Unless otherwise specified, surplus excavated material shall be disposed of at the Contractor's expense. The Contractor shall satisfy himself that there is sufficient material available for the completion of the work before disposing of any material inside or outside the site. Shortage of material, caused by premature disposal of any material by the Contractor, shall be replaced by the Contractor at his expense.

C. Hauling

When hauling is done over highways or streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned to avoid spillage.

D. Maintenance of Roadways

All earthwork operations shall be performed in a manner which does not disrupt the continuous flow of traffic on existing roadways. All public streets shall be swept clean daily where dirt and debris result from Contractor's operations.

E. Finish Grading

Finish grades and existing or natural grades in the area of work are indicated on the plans. The Contractor shall do all grading, filling or excavating as required to completely grade the site to lines and grades shown. Where finished grade corresponds practically with existing grade, the ground shall be worked up and graded off evenly with existing grade. Filled areas shall be compacted so as to prevent settlements and the Contractor shall be responsible for a period of one year after final acceptance of the project to provide additional fill as necessary to bring to grade any areas which settle below the indicated grades and to replace or repair any planting or work damaged by such settlement.

G. Tolerances

Finished grade shall be to the line and grade shown on the plans to within a tolerance of plus or minus 0.3 ft for general grading and 0.1 ft for structures. Allowance for surface treatments and subgrade thickness shall be made so that the specified thickness can be applied to attain the finished grade.

H. Control of Erosion

The Contractor shall maintain earthwork surfaces true and smooth and protected from erosion.

I. Overexcavation of unsuitable soils

Where organic materials, yielding subgrade, or other deleterious materials are encountered during excavations, they shall be removed, as directed by the Contracting Officer's Representative. The resulting excavation shall be backfilled with material approved by the Contracting Officer's Representative. The Contractor shall promptly notify the Contracting Officer's Representative if these materials are encountered and overexcavation shall not proceed without approval of the Contracting Officer's Representative.

3.2 EXCAVATION

A. General

Excavation shall be in accordance with the grading plan indicated on the drawings and as required for construction. Excavations shall be kept free from water while construction is in progress. The Contracting Officer's Representative shall be notified immediately in writing in the event that it becomes necessary to remove soft, weak, or wet material.

Soil disturbed or weakened by the Contractor's operations and soils permitted to soften from exposure to weather shall be excavated to firm foundation and refilled with 6-inch minus quarry rock. All work of this nature will be at the Contractor's expense.

3.3 SUBGRADE PREPARATION

A. Ground surfaces receiving fill shall be prepared by clearing and grubbing as specified in Section 02160, Site Preparation, and by removing soil which is high in organic content and other deleterious material.

3.4 SALVAGE, SORTING AND STAGING SPECIFIED CATEGORIES OF SUBSTRATE

A. The Contractor shall salvage specified materials prior to excavation or backfilling

B. The Contractor shall sort and mix excavated materials to generate volumes of specified substrate categories identified on the Drawings. Sorting and mixing shall occur in conformance with gradations specified in Section 05001 Channel and Floodplain Fill

C. The Contractor shall stage at an approved staging area salvaged and sorted materials for use during construction.

3.5 FILLING OPERATIONS

A. Filling operations shall comply with grading plan shown in the Drawings.

B. Backfill materials shall comply with substrate categories and specified gradations identified in the Drawings and Specifications.

3.6 COMPACTION

A. Compaction requirements for individual fill components shall comply with specifications listed on the Drawings. At a minimum, compaction for finished ground surfaces created from fill shall be in one foot lifts using the weight of equipment with minimum weight of 15 tons. Compaction of fill within structures shall be by equipment bucket compaction.

B. Compaction shall be measured by an independent testing agency at the expense of the contractor. Results of compaction testing shall be provided for constructed embankments.

3.7 CLEAN UP

After completing all earthwork, the Contractor shall leave the site in a neat and clean condition, doing such grading as is required by the plans. Any existing features, structures, and other facilities damaged or affected by the work shall be replaced, repaired, or restored to their original condition or better.

END OF SECTION

SECTION 02410

GEOSYNTHETIC CLAY LINER

PART 1 – GENERAL

1.1. SCOPE

This section includes labor, supplies, materials, equipment and incidentals necessary for furnishing and installing a geosynthetic clay liner (GCL) in compliance with the Drawings.

1.2. RELATED WORK

A. Section 01600, Protection of Materials
B. Section 02200, Earthwork

1.3. APPLICABLE PUBLICATIONS

ASTM D792 (2013) Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

ASTM D1505 (2010) Standard Test Method for Density of Plastics by the Density-Gradient Technique

ASTM D4873 (2009) Standard Specifications for Identification, Storage, and Handling of Geosynthetic Rolls and Samples

ASTM D5199 (2012) Standard Test Method for Measuring Nominal Thickness of Geosynthetics

ASTM D5261 (2010) Standard Test Method for Measuring Mass Per Unit Area of Geotextiles

ASTM D5887 (2009) Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter

ASTM D5888 (2011) Standard Guide for Storage and Handling of Geosynthetic Clay Liners

ASTM D5889 (2011) Standard Practice for Quality Control of Geosynthetic Clay Liners

ASTM D5890 (2011) Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners

ASTM D5891 (2009) Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners

ASTM D5993 (2009) Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners

ASTM D5994 (2010) Standard Test Method for Measuring Core Thickness of Textured Geomembrane

ASTM D6496 (2009) Standard Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners

ASTM D6768 (2009) Standard Test Method for Tensile Strength of Geosynthetic Clay Liners

1.4. SUBMITTALS

A. Prepare and submit a GCL installation plan for approval by the Contracting Officer's Representative at least ten days prior to installation. The plan shall include installation sequencing and installation means/methods.
B. Submit following a minimum of 14 days prior to shipment of materials:
    1. Manufacturer's qualifications.
    2. Manufacturer's data sheets signed by a person having legal authority to bind the company.
    3. Certified test results.

2. PART 2 – PRODUCTS

2.1. GEOSYNTHETIC CLAY LINER

A. The GCL shall be a manufactured product consisting of a sodium montmorillonite clay (bentonite) layer evenly distributed between two (2) geotextiles or attached to a polyethylene geomembrane. The exposed surface of the polyethylene membrane can be smooth or textured.
B. Encapsulating geotextiles shall be mechanically bonded together using a needle punch or stitch bonding process. The GCL shall be free of tears, holes, or other defects that may affect its serviceability
C. Minimum overlap guide-line and a construction match-line delineating the overlap zone shall be imprinted with non-toxic ink on both edges of the GCL panel to ensure the accuracy of the seam and achieve the minimum overlap.
D. Woven/nonwoven geotextiles shall have a minimum seam overlap of six (6) inches for scrim reinforced and 12 inches minimum for all non-scrim reinforced nonwoven GCLs. End of panel or butt end seams shall be a minimum of 12 inches for all oven/nonwoven GCLs, 12 inches for all scrimreinforced double nonwoven GCLs, and 24 inches for non-scrim reinforced double nonwoven GCLs.
E. Bentonite used for sealing seams, penetrations, or repairs, shall have the same properties as the granular bentonite as used in the production of the GCL.
F. The GCL shall meet the minimum average roll values (MARV) requirements that meet the test method in Table 1 below.

TABLE 1 -GCL PROPERTIES		
Test Method		**Test Value**
BENTONITE		
Swell Index Test, minimum	ASTM D5890	24 mL
Fluid Loss, maximum	ASTM D5891	18 mL
UPPER GEOTEXTILE PROPERTIES		
Material Type		Woven/Nonwoven
Mass per Unit Area, min.	ASTM D5261	6 oz/sq yd (min) or as specified in Special Provisions
LOWER GEOTEXTILE PROPERTIES		
Material Type		Woven/Nonwoven
Mass per Unit Area, min.	ASTM D5261	6 oz/sq yd (min) or as specified in Special Provisions
GEOMEMBRANE		
Thickness, minimum	ASTM D5199 ASTM D5994	As Specified in Special Provisions
Sheet Density, minimum	ASTM D1505 ASTM D792	0.92 g/cc
COMPOSITE		
Bentonite Mass/Unit Area, minimum 1	ASTM D5993	0.75 lbs/sq ft
Moisture Content, maximum	ASTM D5993	12 %
Tensile Strength, minimum, (MD and CD)	ASTM D6768	30 lbs/inch
Index Flux, maximum	ASTM D5887	1x10-8 m3/m2/sec
Peel Strength, min. MDPeel Strength, MARV MD 2	ASTM D6496	3.5 lbs/inch

[1]Bentonite mass/unit area shall be computed at 0% moisture content. Bentonite mass/unit area is exclusive of glues added to the bentonite.

[2]The peel test applies to geotextile backed GCL products only.

2.2. MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

Provide materials from manufacturers with an established quality control program ensuring compliance with the requirements of the applicable standards. Provide documentation describing the quality control program upon request. Product(s) not meeting the specified requirements shall be rejected.

3. PART 3 – EXECUTION

3.1. GCL INSTALLATION PLAN

A. Prepare and submit to CONTRACTING OFFICER'S REPRESENTATIVE a GCL Installation Plan including, but not limited to, the following:
    1. Procedures for unloading and storage of GCL rolls.
    2. Method of GCL placement. Design the layout to keep field seams of the GCL to a minimum and consistent with proper methods of GCL installation.
    3. Weather considerations.
    4. GCL seaming and repair procedures.
    5. Verification of the GCL specifications and manufacturer's experience.
    6. Test reports and QC certificates.

3.2. DELIVERY

A. Deliver, store, and handle the GCL in accordance with ASTM D5888.
B. Unload rolls from the delivery vehicles in a manner that prevents damage to the GCL and its packaging.
C. Each GCL roll shall be labeled with the manufacturer's name, product identification number, roll number, and roll dimensions. Rolls shall be packaged in an opaque, waterproof, protective UV resistant covering and wrapped around a central core.
D. Repair or restore tears in the packaging to restore a waterproof protective barrier around the GCL.
E. The presence of free-flowing water within the packaging of unreinforced GCL shall require that roll to be rejected for use.

3.3. STORAGE

A. Protect rolls of GCL from construction equipment, chemicals, sparks, and flames, temperatures in excess of 160 degrees Fahrenheit, or any other environmental conditions that may damage the physical properties of the GCL. Temporary storage at the Site shall be on a level surface that is free of weeds and sharp objects, and where water cannot accumulate.
B. Storage of the rolls on blocks or pallets will not be allowed unless the GCL rolls are fully supported as approved by CONTRACTING OFFICER'S REPRESENTATIVE.
C. Stacks of GCL rolls shall be no greater than three (3) high. Cover GCL rolls stored outdoors with a water-proof tarpaulin or plastic sheet.
D. Store bagged bentonite material on pallets or other suitably dry surface to prevent undue pre-hydration. Tarp next to GCL rolls unless other more protective measures are available.

3.4. HANDLING

A. Unload and handle GCL rolls with load carrying straps, a fork lift with a stinger bar, roller cradles, or a spreader bar assembly.
B. Use a pipe or solid bar of sufficient strength to support the full weight of a roll without significant bending. Chains shall be used to link the ends of the pipe or bar to the ends

of a spreader bar. The spreader bar shall be wide enough to prevent the chains from rubbing against the ends of the roll.

C. The stinger bar shall be at least three-fourths (3/4) the length of the core and capable of supporting the full weight of the roll without significant bending.
D. Roller cradles support the entire width of the GCL roll and allow it to unroll freely.
E. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.
F. Do not drag GCL rolls along the ground, lift by one end, or drop to the ground.

3.5. SUBGRADE PREPARATION

A. Prepare the surface underlying the GCL to be smooth and free of roots or protrusions which could damage the GCL. Do not place GCL prior to inspection and approval of subgrade by CONTRACTING OFFICER'S REPRESENTATIVE. Place and compact subgrade materials in accordance with Section 02200 Earthwork.
B. Where the GCL is the sole barrier, subgrade surfaces consisting of gravel or granular soils may not be acceptable due to the large void content. The subgrade shall be greater than eighty percent (80%) fines and contain no particles larger than 1 inch. Provide and install a suitable cushion layer where needed.
C. Immediately prior to installation of the GCL, compact the subgrade to fill in any remaining voids or desiccation cracks and to eliminate sharp irregularities or

3.6. INSTALLATION

A. Notify CONTRACTING OFFICER'S REPRESENTATIVE a minimum of ten (10) days prior to installation of GCL. Install GCL to the lines and grades as shown on the Drawings.
B. Immediately prior to installation remove the packaging carefully without damaging the GCL. Roll out and install the GCL in accordance with the GCL Installation Plan and as recommended by manufacturer, proceeding from highest elevation to lowest to facilitate drainage in the event of precipitation. Shingle panel layout and deployment with overlaps having the upstream panel shingled over downstream panel. Install all slope panels parallel to the maximum slope; panels in flat areas require no orientation.
C. Install GCL rolls using proper spreader and rolling bars so that the GCL is not stretched during deployment. Avoid dragging the GCL. Use a slip-sheet to position the liner to protect GCL from underlying materials.
D. If the GCL is prematurely hydrated greater than thirty percent (30%) moisture, CONTRACTING OFFICER'S REPRESENTATIVE will determine whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design. Remove and replace GCL which has been hydrated, as requested by CONTRACTING OFFICER'S REPRESENTATIVE, prior to being covered by an overlying geomembrane or cover soil. Hydrated GCL is defined as having become soft as determined by squeezing the material with finger pressure or material which has exhibited swelling.

E. Only install as much GCL as can be covered by the end of the day. No GCL shall be left exposed overnight. Temporarily cover the exposed edge of the GCL with a tarpaulin or other such water resistant sheeting until the next working day.
F. When tying into existing GCL, perform all excavation of previously installed GCL by hand to prevent damage.
G. CONTRACTING OFFICER'S REPRESENTATIVE will inspect each panel, after placement and prior to seaming, for damage and/or defects. Replace or repair defective or damaged panels at no cost to the Contracting Officer.
H. Anchor all GCL as shown on the Drawings and consistent with manufacturer's recommendations.
I. In the presence of wind, weigh down the GCL with sand bags or approved equivalent. Such weighting shall remain in place until replaced with cover material.

3.7. ANCHOR TRENCHES

A. For an anchor trench excavated in cohesive soil susceptible to desiccation, excavate only the amount of anchor trench required for placement of GCL in a single day. Remove ponded water from the anchor trench while the trench is open.
B. Round trench corners to avoid sharp bends in the GCL.
C. Remove loose soil, rocks larger than 1/2-inch in diameter, and any other material which could damage the GCL from the surfaces of the trench.
D. Extend the GCL down the front wall and across the bottom of the anchor trench.
E. On gentle slopes or in locations where it is difficult to create an anchor trench, the GCL may be anchored by a material run-out past the crest of the slope, as approved by CONTRACTING OFFICER'S REPRESENTATIVE.
F. Backfill and compact the anchor trench.

3.8. SEAMS

A. On side slopes, place GCL with seams oriented parallel to the line of maximum slope and free of tension or stress upon completion of installation. Position panels with the overlap recommended by the manufacturer, but not less than 6 inches for panel sides or 18 inches for panel ends.
B. Remove soil or other foreign matter from the overlap area immediately prior to seaming.
C. If recommended by the manufacturer, place granular bentonite of the same type as the bentonite used for the GCL along the entire overlap width at a minimum rate of 0.25 pounds per linear foot or as recommended.
D. Use construction adhesive or construction adhesive or other approved seaming methods recommended by the manufacturer for horizontal seams on slopes.

3.9. PROTECTION

A. Protect GCL during installation from equipment, stones or excessive moisture, tears, and other damage.
B. Do not allow equipment to remain on top of the installed GCL overnight. Remove and store all equipment away from the installed GCL.
C. Vehicular traffic across the GCL is not allowed.
D. Do not refuel equipment or allow fuel containers on top of or near the installed GCL.
E. Personnel working on the GCL shall not smoke, wear damaging shoes, or perform any activity that may damage the GCL.
F. Place a scrap geomembrane sheet underneath equipment necessary to perform the installation (generators, compressors, etc.) to protect the installed GCL from possible damage.

3.10. REPARIS

A. Repair rips or tears to the GCL on flat surfaces by completely exposing the affected area, removing all foreign objects or soil, and placing a patch cut from unused GCL over the damage with a minimum overlap of 12 inches on all edges or as recommend by manufacturer. Damaged material may be left in place under repair.
B. Repair rips or tears to the GCL on slopes using the same procedures above. Adhere the edges of the patch to the repaired liner with a construction adhesive or other approved method as recommended by the manufacturer to keep the patch in position during backfill or cover operations.
C. If recommended by the manufacturer, apply granular bentonite or bentonite mastic in the overlap area.

3.11. PENTRATIONS

A. Penetration details shall be as recommended by the GCL manufacturer. As a minimum, incorporate a collar of GCL wrapped around the pipe and securely fasten for pipe penetrations.
B. Place dry bentonite or bentonite paste around the penetration as recommended by the GCL manufacturer.

3.12. COVERING

A. Do not cover the GCL until it has been inspected and approved by CONTRACTING OFFICER'S REPRESENTATIVE.
B. Install cover soil in a manner that prevents soil from entering the GCL overlap zone, tensile stress from being mobilized in the GCL, and wrinkles from folding over. Use equipment with ground pressures less than 7 pounds per square inch to place the first lift over the GCL. Do not use scrapers or pans directly over the GCL.
C. Do not drive heavy vehicles onto the GCL until the proper thickness of cover is installed. Maintain a minimum thickness of 12 inches of cover between the GCL and heavy equipment.

D. Prior to placement, fill material shall be approved by the Contracting Officer's Representative.
E. The initial lift(s) of soil cover shall not be compacted in excess of eighty-five percent (85%) Modified Proctor density or as specified by CONTRACTING OFFICER'S REPRESENTATIVE.
F. In sloped areas, push cover soil up-slope to minimize tension on the GCL.
G. Place liner fill from the bottom of the slope upward and do not drop onto the GCL from a height greater than 1 foot.
H. Care shall be taken when covering the liner to prevent any damage to the GCL. At no time will construction equipment come into direct contact with the Geomembrane. If damage occurs, it will be repaired at the contractor's expense.

END OF SECTION

SECTION 02900

SEEDING

PART 1 - GENERAL

1.1 DESCRIPTION:
This section specifies seeding areas including hand broadcast seeding, compost seeding, drill seeding and hydroseeding. The Contractor shall provide all labor, tools, equipment, materials and incidentals necessary to complete the Work as specified.

1.2 RELATED WORK:

A. Section 01300, Submittals
A. Section 01560, Environmental Controls
B. Section 01600, Protection of Materials
C. Section 01640, Government Supplied Materials

1.3 QUALITY ASSURANCE:

A. The Contracting Officer's Representative will mark by flags or stakes the outer extent of each seeding location prior to seeding.
B. The Contracting Officer's Representative shall be notified at least 48 hours in advance of planting.

1.4 SUBMITTALS:

A. Seed mixes shall be approved by Contracting Officer's Representative
B. Seeding equipment and contractor qualifications shall be approved by Contracting Officer's Representative
C. Compost samples shall be submitted to the Contracting Officer's Representative for approval prior to being used and must comply with all local, state and federal regulations.
D. Mulch and tackifier shall be approved by Contracting Officer's Representative.

1.5 APPLICABLE PUBLICATIONS:

ANSI Z60.1-2004 American Nursery and Landscape Association: American Standard for Nursery Stock
USCC TMECC guidelines for laboratory procedures
TMECC 02.02-B, "Sample Sieving for Aggregate Size Classification"

PART 2 - PRODUCTS

2.1 SEED MIX

Seed Name	% Pure Live Seed	Lbs. Per Acre
Western Wheatgrass	30	*
Streambank Wheatgrass	20	*
Hard Fescue	20	*
Slender Wheatgrass	15	*
Green Needlegrass	15	*

* Drilled Rate = 25 lbs/acre, Broadcast and Hydroseed Rate = 50 lbs/acre

2.2 COMPOST

Compost shall be weed free and derived from a well-decomposed source of organic matter. The compost shall be produced using an aerobic composting process meeting CFR 503 regulations, including time and temperature data indicating effective weed seed, pathogen and insect larvae kill. The compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products will not be accepted. Test methods for the items below should follow USCC TMECC guidelines for laboratory procedures:

- PH – 5.0-8.0 in accordance with TMECC 04.11-A, "Electrometric pH Determinations for Compost"
- Particle size – 99% passing a 2" sieve and a minimum of 60% greater than the 3/8" sieve, in accordance with TMECC 02.02-B, "Sample Sieving for Aggregate Size Classification". *(Note- In the field, product commonly is between ½" and 2" particle size.)*
- Moisture content of less than 60% in accordance with standardized test methods for moisture determination.
- Material shall be relatively free (<1% by dry weight) of inert or foreign man made materials.
- An example acceptable compost product for this type of application is an approved Filtrexx FilterMedia™, as determined by testing procedures outlined by Filtrexx International, LLC.

PART 3 - EXECUTION

3.1 HAND BROADCAST SEEDING

Sow seed at rate as indicated on the drawings. Contractor shall plant seed using the hand broadcast method, whereby seed is scattered on the surface of the ground instead of planted in the ground.

3.2 COMPOST SEEDING

Compost seeding is a process that applies a combination of organic compost and seed using a compost blower. Following microtopographic grading, a mixture of compost and seed will be applied to designated areas using a pneumatic blower. Compost and seed shall be mixed according to prescribed ratios as provided by the manufacturer and/or Contracting Officer's Representative. Compost/seed mixture shall be applied at a depth of 2" over the entire seeding area. The seed mix and seeding rates are approximate. Seed mixes will depend on

availability of seed at the time of application. Seed mixes and corresponding seeding rates will be provided by Contracting Officer's Representative at the time of application.

3.3 DRILL SEEDING

Drill seeding is an application method where the seed is placed in the ground, resulting in better protection and seed to soil contact. Drill seeding is the preferred method for seeding construction disturbance areas such as materials staging areas and temporary access roads, following project implementation. Specific locations and total area to be drill seeded will be determined following project implementation.

The seed drill should be capable of accurately seeding native grass and forb species. This requires a seed drill with multiple seed boxes for different seed sizes or an in-box seed agitator. The seed mix and seeding rates are approximate. Seed mixes will depend on availability of seed at the time of application. Seed mixes and corresponding seeding rates will be provided by Contracting Officer's Representative at the time of application.

3.4 HYDROSEEDING

Hydroseeding is a process that incorporates hand broadcast seed application, followed by application of a mulch and tackifier via pneumatic blower. Contractor shall plant seed using the hand broadcast method, whereby seed is scattered on the surface of the ground instead of planted in the ground. Following microtopographic grading and hand broadcast seeding, an approved combination of mulch and tackifier will be applied to the entire seeded area using a pneumatic blower. Mulch/tackifier mixture shall be applied immediately following seeding. Mulch/tackifier mixture shall be applied in quantities as prescribed by manufacturer's specifications for project area slopes. The seed mix and seeding rates are approximate. Seed mixes will depend on availability of seed at the time of application. Seed mixes and corresponding seeding rates will be provided by Contracting Officer's Representative at the time of application.

END OF SECTION

SECTION 02920

FENCE

PART 1 – GENERAL

1.1 SCOPE

This section specifies installation of wildlife fencing. Work governed by this specification includes furnishing fencing and gate materials, and supplying labor and equipment to install fencing and gates.

1.2 RELATED WORK:

A. Section 01300, Submittals
B. Section 01560, Environmental Controls
C. Section 01600, Protection of Materials
D. Section 02920, Fence

1.3 QUALITY ASSURANCE:

A. The Contracting Officer's Representative will mark, by stakes or flags, the location of the fence.
B. Provide product data in compliance with Section 01300 Submittals.

PART 2 – MATERIALS

2.1 POSTS

Wooden posts for fencing shall be 4 inches in diameter and 12 feet long. Wooden posts for fence corners shall be 6 inches in diameter and 12 feet long. Posts shall be pressure treated wood.

2.2 FENCE FABRIC

Fence fabric shall consist of sturdy plastic mesh fencing material at least 7.5 feet in height.

2.3 CABLE TIES

Cable ties shall be 12" releasable UV stabilized plastic.

2.4 GROUND STAKES

Ground stakes shall consist of 18 inch long, kinked ground stakes

PART 3 – EXECUTION

3.1 CLEARING AND GRUBBING

The path of fence installation shall be cleared of woody debris or other material that may interfere with the ability of the fence to be staked securely to the ground.

3.2 LAYOUT

The fence shall be offset approximately 5 feet from the perimeter of the area to be protected.

3.3 POST INSTALLATION

Unless otherwise specified, posts shall be installed at a 15 foot, center to center spacing on horizontal ground, and at less than 15 foot spacing on sloping ground. Posts 12 feet in length shall be driven 4 feet into the ground.

3.4 FENCING FABRIC INSTALLATION

Fence fabric shall be secured to the outside of the posts with 12" UV stabilized releasable cable ties. Fence shall be secured to post in at least five locations. At least six inches of fencing shall be left to overlap on the ground. This overlap shall be staked into the ground using 18" kinked, galvanized ground stakes to prevent deer and other small mammals from entering the exclosure under the fence. Transitions between fence sections, where one roll ends and another begins, shall overlap 3 feet and be secured using releasable cable ties. Fence fabric shall be tight and the top of the fence must be uniform and even at 7.5 ft above the ground surface. There shall be no sagging in the fence material between posts.

3.5 GATES

Gates shall be constructed from fence fabric. Vehicle gates shall be 12 feet wide. Pedestrian gates shall be 3 feet wide. Gates shall have two connection points for latches.

3.6 BRACING

Brace assemblies shall be located at all corners, gates and abrupt changes in vertical topography (generally considered as 15 degrees). On straight reaches of fencing line braces shall be installed at a spacing of no more than 600 feet.

END OF SECTION

SECTION 02931

VEGETATION SALVAGE AND TRANSPLANT

PART 1 - GENERAL

1.1 DESCRIPTION:
This section specifies the salvage and transplant of shrubs and sedge sod.

1.2 RELATED WORK:
A. Section 01560, Environmental Controls
B. Section 01600, Protection of Materials
C. Section 01640, Government Supplied Materials

1.3 QUALITY ASSURANCE:
A. The Contractor will mark by flags or stakes the outer extent of each salvage location prior to construction.
B. The Contracting Officer's Representative shall be notified at least 48 hours in advance of salvage activities.

1.4 SUBMITTALS:
A. Submit in accordance with Section 01300, Submittals.
B. Written description identifying staging areas as needed for sedge sod mats.

1.5 APPLICABLE PUBLICATIONS:

USDA-NRCS	Plant Materials Technical Note No. 22: Wetland Sod Mats
Landowner Resource Centre	Extension Notes Ontario: Successful Transplanting of Woodland Vegetation for Plant Salvage or Habitat Restoration Projects

PART 2 - PRODUCTS

2.1 SHRUBS
Shrubs found in salvage areas identified within construction limits shall be produced. Shrubs shall be a maximum height of 15 feet.

2.2 SEDGE SOD MATS
Sedge sod mats in salvage areas identified within construction limits shall be produced. Sedge sod mats shall consist of native sedge, rush, and grass species. Reed canarygrass cover shall be less than 10%. Sedge sod mats shall be approximately 3-feet wide, 6-feet long, and 6-12 inches deep.

PART 3 - EXECUTION

3.1 SALVAGE

Shrubs shall be salvaged from locations specified on the drawings. Contracting Officer's Representative shall flag individual shrubs for salvage. Shrubs shall be salvaged using a tree spade or with machinery with a bucket capacity of at least one cubic yard. Care shall be taken to excavate the entire root mass and attached substrate. Excavation should extend to 1.5 times the width of the drip line of the shrub. Transplant locations shall be prepared prior to salvage of shrubs.

Sedge sod mats shall be salvaged in quantities and from locations specified on the drawings. Sedge sod shall be salvaged in approximately 3 foot by 6 foot mats using equipment with a sharp-edged steel plate that undercuts the sod. Sedge sod mats shall be salvaged to a depth of 6 to 12 inches. Transplant locations shall be prepared prior to salvage of sedge sod mats.

Contractor shall provide all labor, tools, equipment, and incidentals necessary to complete the Work as specified.

3.2 TRANSPLANT

Shrub transplant locations shall be identified and staked by the Contractor prior to salvage of shrubs. Transplant locations shall be field-fit by Contracting Officer's Representative and located on finished surfaces within the bankfull floodplain. Shrubs shall be directly planted in transplant locations and staging and multiple movements of shrub materials shall be avoided. Transplant holes shall be wider and deeper than the salvaged root mass so that the entire root mass and attached substrate fits into the transplant hole. The salvaged shrub shall be planted so that the root mass crown is at the pre-transplant elevation relative to adjacent ground. Each transplanted shrub shall be water after transplanting so that the entire transplanted root mass is saturated.

Streambank treatment areas where sedge sod is specified shall be prepared prior to sedge mat salvage. Sedge sod mats shall be directly transplanted when possible. Transplant site preparation shall be done as specified on the drawings. It may be necessary to stage salvaged sedge sod mats in temporary locations prior to transplanting. Temporary staging locations shall be located prior to sedge sod mat salvage. Temporary staging locations shall be cleared of existing vegetation prior to transplant to expose mineral soil. Temporary staging locations shall have hydrology suitable to maintain species composition in salvaged sedge sod mats.

Contractor shall provide all labor, tools, equipment, and incidentals necessary to complete the Work as specified.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories

D. Form stripping.

1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 03300 – Cast-In-Place Concrete: Supply of concrete accessories for placement by this Section.

1.03 RELATED SECTIONS

A. Section 03210 – Concrete Reinforcement.

B. Section 03300 – Cast In-Place Concrete.

1.04 REFERENCES

A. ACI 347 – Recommended Practice For Concrete Formwork.

B. PS-1 – Construction and Industrial Plywood.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347 and 318.

1.06 QUALIFICATIONS

A. Submittal per Section 01300.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.08 COORDINATION

A. Coordinate this Section with other Sections of work which require attachment of components to formwork.

PART 2 – PRODUCTS

2.01 WOOD FORM MATERIALS

A. Plywood: Douglas Fir species; select sheathing, tight face grade; sound undamaged sheets with clean, true edges.

B. Lumber: Douglas Fir species; No. 2 or better grade; with grade stamp clearly visible.

2.02 FORMWORK ACCESSORIES

A. Form Ties: Removable or Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch back break dimension, free of defects that could leave holes larger than one inch in concrete surface.

B. Form Release Agent: Colorless mineral oil that will not stain concrete or absorb moisture.

C. Corners: Chamfered with rigid plastic or wood strip.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

E. Waterstops: Virgin Polyvinyl chloride, minimum 1,750 psi tensile strength, minus 50 degrees F to plus 175 degrees F working temperature range, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; manufactured by Vinylex or Greenstreak or approved equal.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.02 EARTH FORMS

A. Earth forms are not permitted.

3.03 ERECTION – FORMWORK

A. Erect formwork to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on Drawings.

F. Provide chamfer strips on external corners as required.

3.04 APPLICATION – FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops continuous without displacing reinforcement. Heat seal joints watertight. All horizontal and vertical waterstops shall be tied off in two directions every 12 inches in such a manner that bending over one way or another is prevented.

All waterstops shall be properly spliced and joints shall be checked for strength and pinholes after splicing.

Splices shall be strong enough to develop a pulling force of 75 percent of the strength of the waterstop, and shall be watertight.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms, unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES AND CAMBER

A. Construct formwork to maintain tolerances required by ACI 301.

B. Camber elevated slabs in accordance with the drawings or as directed by the Contracting Officer's Representative.

3.08 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and all other items are secure.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

3.10 SCHEDULES

END OF SECTION

SECTION 03210

REINFORCING STEEL

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.02 RELATED SECTIONS

A. Section 03100 – Concrete Formwork.

B. Section 03300 – Cast-in-Place Concrete.

1.03 REFERENCES

A. ACI 301 – Structural Concrete for Buildings.

B. ACI 318 – Building Code Requirements for Reinforced Concrete.

C. ACI SP-66 – American Concrete Institute – Detailing Manual.

D. ASTM A82 – Cold Drawn Steel Wire for Concrete Reinforcement.

E. ASTM A184 – Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

F. AWS D1.4 – Structural Welding Code for Reinforcing Steel.

G. AWS D12.1 – Reinforcing Steel Welding Code.

H. ASTM A615 – Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

I. ASTM A706 – Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

J. CRSI – Concrete Reinforcing Steel Institute Manual of Practice.

K. CRSI 63 – Recommended Practice for Placing Reinforcing Bars.

L. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing devices and tie details.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice, ACI 301, ACI SP-66, and ACI 318.

B. Submit certified copies of mill test report of reinforcement materials analysis.

1.06 QUALIFICATIONS

A. Submittal per Section 1300.

1.07 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 – PRODUCTS

2.01 STEEL REINFORCEMENT

A. <u>Deformed Reinforcing Bars</u>

1. Unless otherwise specified, reinforcing steel shall be Grade 60 billet steel conforming to ASTM A 615.
2. Varying grades shall not be used interchangeably in structures.
3. All such reinforcing shall be deformed steel bars with deformations conforming to the requirements set forth in ASTM Specification A 615.
4. Steel bending processes shall conform to the requirements of ACI-318.
5. Reinforcing to be bent or straightened shall conform to ASTM A 706 and be accomplished so that the steel will not be damaged.
6. Kinked bars shall not be used.

2.02 ACCESSORY MATERIALS

A. Reinforcement Supports

1. Bar supports shall conform to ACI 315.
2. Bar supports shall consist of approved concrete blocks, stainless steel chairs, plastic spacers or plastic shim plates.
   a. Concise blocks shall, as a minimum, be no less than in compressive strength or cement content as the concrete in which it will be cast. Blocks manufactured from plastic or with low cement contents will not be accepted. Brick, broken concrete masonry units, spalls, rocks or similar materials shall not be used for support of reinforcing steel.
   b. Steel chairs shall be furnished with plastic tips when incorporated into concrete exposed to view.

B. Steel Tie Wire: annealed steel tie wire (minimum 16 gage) shall be used to fasten the reinforcing steel in place.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.

B. Weld reinforcing in accordance with CRSI Manual of Practice.

C. Locate reinforcing splices not indicated on Drawings, at point of minimum stress. Review location of splices with Contracting Officer's Representative.

PART 3 – EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Accommodate placement of formed openings.

C. Maintain concrete cover around reinforcing as called for on the Drawings.

3.02 FIELD QUALITY CONTROL

A. Field inspection will be performed by the Contracting Officer's Representative prior to concrete pours.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete floors and slabs.

B. Control, and expansion and contraction joint devices associated with concrete work, dowel attachments, and joint sealants.

C. Cast-in-place concrete walls.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03100 – Concrete Formwork: Placement of joint sealer in formwork.

1.03 RELATED SECTIONS

A. Section 03100 – Concrete Formwork: Formwork and accessories.

B. Section 03210 – Concrete Reinforcement.

1.04 REFERENCES

A. ACI 301 – Structural Concrete for Buildings.

B. ACI 302 – Guide for Concrete Floor and Slab Construction.

C. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

D. ACI 305R – Hot Weather Concreting.

E. ACI 306R – Cold Weather Concreting.

F. ACI 308 – Standard Practice for Curing Concrete.

G. ACI 318 – Building Code Requirements for Reinforced Concrete.

H. ASTM D994 – Preformed Expansion Joint Filler for Concrete (Bituminous Type).

I. ASTM D1190 – Concrete Joint Sealer, Hot-Poured Elastic Type.

J. ASTM D1751 – Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

K. ASTM D1752 – Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

L. ASTM C33 – Concrete Aggregates.

M. ASTM C94 – Ready-Mixed Concrete.

N. ASTM C150 – Portland Cement.

O. ASTM C260 – Air Entraining Admixtures for Concrete.

P. ASTM C330 – Light Weight Aggregates for Structural Concrete.

Q. ASTM C494 – Chemical Admixtures for Concrete.

R. ASTM C618 – Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.05 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on joint devices, attachment accessories, and admixtures.

C. Samples: Submit one 6 inch samples of expansion/contraction joint and control joint as applicable.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

1.06 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01720.

B. Accurately record actual locations of embedded utilities and components, which are concealed from view.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain one copy of each document on site.

C. Acquire cement and aggregate from same source for all work.

D. Conform to ACI 305R when concreting during hot weather.

E. Conform to ACI 306R when concreting during cold weather.

1.08 FIELD SAMPLES

A. Acceptable samples represent a quality level for the work. Coordinate with Section 03100.

B. Field samples shall be conducted by an independent testing agency at the expense of the Contractor.

C. Provide reports within 7 days of testing.

1.09 COORDINATION

A. Coordinate work under provisions of Section 01505.

B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150, Type IA – Air Entraining Portland type.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

2.02 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical: ASTM C494, Type A - Water Reducing, Type B - Retarding, Type C – Accelerating, Type D – Water Reducing and Retarding, Type E - Water Reducing and Accelerating, Type F – Water Reducing, High Range, Type G – Water Reducing, High Range and Retarding admixture.

C. Fly Ash: ASTM C618.

2.03 ACCESSORIES

A. Bonding Agent: Two component modified epoxy resin, Adhesive Engineering LPL1000 or approved equal.

B. Vapor Barrier: 6 mil thick clear polyethylene film.

C. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2400 psi in 48 hours and 5,000 psi in 28 days.

2.04 INTERNAL JOINT SEALS

A. Performance Requirements: The internal joint sealing system shall prevent the leakage of water into the pipe or vault at the joints connecting each section and be capable of withstanding up to 14 feet (6psi) of external head pressure. Leakage shall be construed to mean freely dripping water emanating at the interface between the seal and the pipe or manhole wall or through the body of the seal itself. Moisture appearing at random locations in the form of patches or beads adhering to the surfaces shall not be construed as leakage. The seal shall remain flexible and have the capability to maintain a watertight seal throughout its design life.

B. Sealing of connectors shall conform with ASTM C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

C. Sealing using cementitious grout shall conform with ASTM C-827-82 and ASTM C-191-79.

D. Sealing of rubber gaskets shall conform with ASTM C443-12 Standard Specification for Joints for Concrete Pipe and Manholes using Rubber Gaskets.

2.05 CONCRETE ANCHORS

A. Concrete Anchors: Hot-dipped galvanized or Stainless Steel Concrete Anchors, Hilti Kwik Bolt or approved equal; size, number, and location as shown on the Drawings.

2.06 CONCRETE MIX

A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.

B. Select proportions for normal weight concrete in accordance with ACI 301.

C. Provide concrete to the following criteria:

	Class M-3000	Class M-4000
Minimum 7-Day Lab Strength	2000 psi	2800 psi
Minimum 28-Day Lab Strength	3000 psi	4000 psi
Maximum Aggregate Size	¾-inch	¾-inch
Maximum Water to Cement Ratio	6 Gallons per Sack	6 Gallons per sack
Slump Range	1 ½-inch to 3 inches max	1 ½-inch to 4 inches max
Entrained Air Content	5 to 8%	5 to 8%

D. Use accelerating admixtures in cold weather only when approved by Contracting Officer's Representative. Use of admixtures will not relax cold weather placement requirements.

E. No calcium chloride containing admixture shall be used.

F. Use set retarding admixtures during hot weather only when approved by Contracting Officer's Representative.

G. Unless otherwise shown, all concrete shall have between 4% and 7% entrained air.

H. Unless otherwise shown, all concrete shall have a water/cement (w/c) ratio not exceeding 0.45.

I. Maximum size aggregate shall be 1

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement, waterstops, and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 301, ACI 304, and ACI 318 and as noted therein.

B. Notify Contracting Officer's Representative minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, bearing pads, formed joint fillers, joint devices and waterstops are not disturbed during concrete placement.

D. Install vapor barrier under interior slabs on grade. Lap joints minimum 12 inches and seal watertight at edges and ends.

E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches and seal.

F. Install joint fillers and joint sealers in accordance with manufacturer's instructions.

G. Install joint devices in accordance with manufacturer's instructions.

H. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

I. Install joint device anchors as required. Maintain correct position.

J. Install joints in longest practical lengths, when adjacent construction activity is complete.

K. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

L. Place concrete continuously between predetermined expansion, control, and construction joints. Concrete in walls shall not be placed in layers thicker than 24 inches vertically at any one time except that the bottom layer shall be no thicker than 12 inches. Each layer of concrete shall be thoroughly vibrated before the next layer is placed thereon. Vibrate interfaces between layers thoroughly. Use pour doors to place and vibrate concrete. Concrete shall not be allowed to drop free in excess of 6 feet. Use Tremie tube placement method for forms without pour doors, for pours deeper than 6'-0" vertical.

M. Do not interrupt placement; do not permit cold joints to occur.

N. Place floor slabs in pattern indicated.

O. Screed slab on grade level, maintaining surface flatness of maximum 1/8 inch in 10 ft.

3.04 CONCRETE FINISHING

B. Provide exterior concrete slab with a smooth steel trowel finish which is to be subsequently broomed or tined to leave a medium broomed surface.

C. Finish slabs in accordance with ACI 301.

3.05 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperature, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section 01400.

B. Provide free access to Work and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds

specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

10. Test results shall be reported in writing to Contracting Officer's Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Contracting Officer's Representative but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Contracting Officer's Representative. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Contracting Officer's Representative.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Retain suppliers' data and batch tickets for all concrete incorporated into work, and provide copies to the Contracting Officer's Representative.

3.07 PATCHING

A. Allow Contracting Officer's Representative to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Contracting Officer's Representative upon discovery.

C. Patch imperfections as directed in accordance with ACI 301 and as follows: Defective surfaces such as honeycombed or hollow sounding areas shall be entirely removed to sound concrete, epoxy bond coated, and recast or dry/damp packed as the situation dictates and directed by the Contracting Officer's Representative.

3.08 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances, or is permeable to water or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Contracting Officer's Representative and be performed at the Contractor's expense.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Contracting Officer's Representative for each individual area. All concrete repairs are subject to the approval of the Contracting Officer's Representative.

*** END OF SECTION ***

SECTION 04100

PIPE INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION:
This section includes installation of pipes for culverts, storm sewers and sanitary sewers. Trenching, pipe bedding, pipe laying, connections and backfilling are included in this section.

1.2 RELATED WORK:
A. Section 01400, Construction Staking
B. Section 01600, Protection of Materials
C. Section 02200, Earthwork
D. Section 04200, Pipe Materials and Fittings

1.3 QUALITY ASSURANCE:
A. The Contracting Officer's Representative shall be notified at least 48 hours in advance of pipe installation.
B. The Contracting Officer's Representative shall approve the pipe trenching layout and inspect the construction staking prior to excavation.

1.4 SUBMITTALS:
A. Submit in accordance with Section 01300, Submittals.
B. Submit in accordance with Section 04200, Pipe Materials and Fittings.

PART 2 - PRODUCTS

2.1 GENERAL

This material shall be free from dirt, vegetable matter, cinder, ashes, refuse, organic matter or other unsuitable foreign substance. Frozen material may not be used.

2.2 UTILITY TRENCH BACKFILL

Type 1, Type 2 or Type 3 material shall be a crushed lrock having a minimum of two fractured faces and meet the following gradation requirements by dry weight:

A. Type 1 - Bedding Material

Passing 1 inch sieve.....100%
Passing 3/4 inch sieve.....90-100%
Passing 3/8 inch sieve.....20-55%
Passing #4 sieve.....0-10%
Passing #8 sieve.....0-8%

B. Type 2 - Foundation Material

Passing a 3 inch sieve.....100%
Passing a 3/4 inch sieve.....50-70%
Passing a #4 sieve.....20-40%
Passing a #200 sieve.....0-8%

C. Type 3 - Foundation Material

Passing a 3 inch sieve.....100%
Passing a 1 inch sieve.....0-15%
Passing a #4 sieve.....0-8%

2.3 ROADWAY BACKFILL AND UTILITY TRENCH SPECIAL FOUNDATION MATERIAL

Roadway foundation backfill and utility trench special foundation backfill for stabilization of sub grade shall be a crushed rock with a minimum of two fractured faces and shall meet the following gradations:

A. Type 4 - Foundation Material

Passing the 8 inch sieve.....100%
Passing the 6 inch sieve.....65-85%
Passing the 3 inch sieve.....0-20%
Passing the #200 sieve.....0-5%

B. Stabilization Rock

Shall be further classified as follows:

Class I Stabilization Rock
Class II Stabilization Rock
Class III Stabilization Rock
Class IV Stabilization Rock
Class V Stabilization Rock

Each class of stabilization rock above shall meet the same corresponding Class I-V gradation requirements as riprap in Section 05001. Stabilization rock shall be a crushed rock with a minimum of two fractured faces.

2.4 UNDER DRAIN PIPE TRENCH BACKFILL MATERIAL

A. Rock used as backfill around under-drains shall be clean, washed and sound materials free of excess fines and deleterious materials as specified herein.

B. Rock used as backfill for under-drains or edge-drains shall be Type 1 Bedding Material. Rounded river rock meeting the Type 1 Bedding Material gradation shall be acceptable for installations located behind the curb. Installations located under or in front or the curb and gutter shall be a crushed rock with a minimum of two fractured faces.

2.5 SAMPLING AND TESTING:

Sampling.....SD 201

Gradation.....SD 202

Fractured Faces.....SD 211

PART 3 - EXECUTION

3.1 EXCAVATION AND PREPARATION OF TRENCH

A. Trenches

The length of trench excavation in advance of pipe laying shall be kept to a minimum. Excavations shall either be closed up at the end of the day or protected. The trench shall be excavated to the depth and grade as staked by the Contracting Officer's Representative. Trenches must be of sufficient width in the pipe zone to permit proper installation and bedding of the pipe and to provide the required compaction of backfill. Above the top of the pipe zone, the Contractor may excavate to any width. All boulders and stones shall be removed to provide a minimum of 6 inches clearance under all portions of the pipe.

Placement of bedding material shall precede the installation of all pipes. This shall include necessary leveling of the native trench bottom or the top of the foundation material as well as placement and compaction of required bedding material to a uniform grade so that the entire length of pipe will be supported on a uniformly dense unyielding foundation. When, after excavating to the foundation level, the material remaining in the trench bottom is determined to be unsuitable by the Contracting Officer's Representative, excavation shall be continued to such additional depth and width as required by the Contracting Officer's Representative. Unsuitable foundation materials shall be disposed of at an approved site. The trench foundation shall be backfilled to the bottom of the pipe zone with gravel backfill for foundations, gravel backfill for pipe zone bedding, or other suitable material, and compacted to form a uniformly dense, unyielding foundation.

All material excavated from trenches and piled adjacent to the trench shall be maintained so that the toe of the slope is at least 2 feet from the edge of the trench. It shall be piled to cause a minimum of inconvenience to public travel, and provision shall be made for merging traffic where necessary. Free access shall be provided to all fire hydrants, water valves, and meters; and clearance shall be left to enable free flow of storm water in gutters, conduits, or natural watercourses. If any part of the excavated material meets the specifications of

pipe bedding material, the Contracting Officer's Representative may require that such material, in the quantity required, be selectively removed, stockpiled separately, and used as pipe bedding instead of quantities of gravel backfill for pipe zone bedding. If material so stockpiled becomes contaminated, the Contractor shall furnish suitable material in an amount equal to that lost by contamination at no expense to the Contracting Agency. All costs involved in storing, protecting, re-handling, and placing the material shall be included in other items of work on the project.

Excavation for manholes and other structures connected to the pipelines shall be sufficient to provide a minimum of 12 inches between their surfaces and the sides of the excavation.

The Contractor shall furnish, install, and operate all necessary equipment to keep excavations above the foundation level free from water during construction, and shall dewater and dispose of the water so as not to cause injury to public or private property or nuisance to the public. Sufficient pumping equipment in good working condition shall be available at all times for all emergencies, including power outage, and shall have available at all times competent workers for the operation of the pumping equipment.

B. Shoring

The Contractor shall provide all materials, labor, and equipment necessary to shore trenches to protect the Work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench. The Contractor may elect to use any combination of shoring and overbreak, tunneling, boring, sliding trench shield, or other method of accomplishing the Work consistent with applicable local, State, or Federal safety codes.

If workers enter any trench or other excavation 4 feet or more in depth that does not meet the open pit requirements it shall be shored. The Contractor alone shall be responsible for worker safety, and the Contracting Agency assumes no responsibility.

Upon completing the work, the Contractor shall remove all shoring unless the Drawings or the Contracting Officer's Representative direct otherwise. Shoring to be removed, or moveable trench shields or boxes, shall be located at least 2½ pipe diameters away from metal or thermoplastic pipe if the bottom of the shoring, shield, or box extends below the top of the pipe, unless a satisfactory means of reconsolidating the bedding or side support material disturbed by shoring removal can be demonstrated.

Damages resulting from improper shoring or failure to shore shall be the sole responsibility of the Contractor.

C. Bedding the Pipe

Pipe zone bedding material shall provide uniform support along the entire pipe barrel, without load concentration at joint collars or bells. All adjustment to line and grade shall be made by scraping away or filling in with bedding material under the body of the pipe and not by blocking or wedging. Bedding disturbed by pipe movement, or by removal of shoring movement of a trench shield or box, shall be reconsolidated prior to backfill.

Pipe zone bedding shall be as specified in the Drawings and shall be placed in loose layers and compacted to 90 percent maximum density. Bedding shall be placed, spread, and compacted before the pipe is installed so that the pipe is uniformly supported along the barrel. Lifts of not more than 6 inches in thickness shall be placed and compacted along the sides of the pipe to the height shown in the Drawings. Material shall be worked carefully under the pipe haunches and then compacted.

If the Contracting Officer's Representative determines that the material existing in the bottom of the trench is satisfactory for bedding the pipe, the bedding material specified in the Drawings is not required, provided the existing material is loosened, regraded, and compacted to form a dense, unyielding base.

3.2 LAYING PIPE

A. Survey Line and Grade

Survey line and grade control hubs will be placed in a manner consistent with accepted practices. The Contractor shall transfer line and grade into the trench where they shall be carried by means of a laser beam or taut grade line supported on firmly set batter boards at intervals of not more than 30 feet. Not less than three batter boards shall be in use at one time. Grades shall be constantly checked and in the event the batter boards do not line up, the Work shall be immediately stopped, the Contracting Officer's Representative notified, and the cause remedied before proceeding with the Work. Any other procedure shall have the written approval of the Contracting Officer's Representative.

B. Pipe Laying – General

After an accurate grade line has been established, the pipe shall be laid in conformity with the established line and grade in the properly dewatered trench. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces. All pipe laid in the trench to the specified line and grade shall be kept in longitudinal compression until the backfill has been compacted to the crown of the pipe. All pipe shall be laid to conform to the prescribed line and grade shown in the Drawings, within the limits that follow.

Pipe shall be laid to a true line and grade at the invert of the pipe and the Contractor shall exercise care in matching pipe joints for concentricity and compatibility. In no case shall two pipes be joined together with ends having the maximum manufacturer's tolerance. The invert line may vary from the true line and grade within the limits stated to develop uniformity, concentricity, and uniform compression of jointing material provided such variance does not result in a reverse sloping invert. The limit of the variance at the invert shall not exceed plus or minus 0.03 feet at the time of backfill. Checking of the invert elevation of the pipe may be made by calculations from measurements on the top of the pipe.

The pipe, unless otherwise approved by the Contracting Officer's Representative, shall be laid up grade from point of connection on the existing pipe or from a designated starting point. The pipe shall be installed with the bell end forward or upgrade. When pipe laying is

not in progress, the forward end of the pipe shall be kept tightly closed with an approved temporary plug.

Where pipe joints must be deflected within the manufacturer's recommended limits to accommodate required horizontal or vertical curvature, it shall first be joined in straight alignment and then deflected as required. Where pipe joints must be deflected to an amount greater than the manufacturer's recommended limits to accommodate required horizontal or vertical curvature, the curves shall be achieved with a series of tangents and shop fabricated bends, subject to the approval of the Contracting Officer's Representative.

Upon final acceptance of the Work, all pipe and appurtenances shall be open, clean, and free draining.

C. Pipe Laying – Concrete

For concrete pipe with elliptical reinforcement, the markings indicating the minor axis of the reinforcement shall be placed in a vertical plane (top or bottom) when the pipe is laid.

D. Pipe Laying – Steel or Aluminum

Pipe with riveted or resistance spot welded seams shall be laid in the trench with the outside laps of circumferential joints upgrade and with longitudinal laps positioned other than in the invert, and firmly joined together with approved bands.

Aluminum pipe or pipe arch used in concrete shall be painted with two coats of paint. The aluminum pipe to be painted shall be cleaned with solvent to remove contaminants. After cleaning, the pipe shall be painted with two coats of paint conforming to Federal Specification TT-P-645 (primer, paint, zinc chromate, alkyd vehicle). Aluminized steel pipe will not require painting when placed in Controlled Density Fill (CDF) or when in contact concrete head walls. All costs of cleaning and painting the aluminum surfaces as specified shall be included in the unit Contract price per linear foot for the aluminum pipe or pipe arch.

E. Rubber Gasketed Joints

In laying pipe with rubber gaskets, the pipe shall be handled carefully to avoid knocking the gasket out of position or contaminating it with foreign material. Any gasket so disturbed shall be removed, cleaned, relubricated if required, and replaced before joining the sections.

The pipe shall be properly aligned before joints are forced home. Sufficient pressure shall be applied in making the joint to ensure that the joint is home, as defined in the standard installation instructions provided by the pipe manufacturer. The Contractor may use any method acceptable to the Contracting Officer's Representative for pulling the pipe together, except that driving or ramming by hand or machinery will not be permitted. Any pipe damaged during joining and joint tightening shall be removed and replaced at no expense to the Contracting Agency. Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most gasketed joints

tend to creep apart when the end of the pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

Sufficient restraint shall be applied to the line to ensure that joints once home are held so by compacting backfill material under and alongside the pipe or by other acceptable means. At the end of the work day, the last pipe shall be blocked in such a manner as may be required to prevent creep.

F. Plugs and Connections

Plugs for pipe branches, stubs, or other open ends which are not to be immediately connected shall be made of an approved material and shall be secured in a place with a joint comparable to the main line joint, or stoppers may be of an integrally cast breakout design.

G. Jointing of Dissimilar Pipe

Dissimilar pipe shall be jointed by use of a factory-fabricated adapter coupling or a pipe collar as detailed in the Drawings.

H. Sewer Line Connections

Storm and sanitary sewer line connections to trunks, mains, laterals, or side sewers shall be left uncovered until after the Contracting Officer's Representative has inspected and approved the Work. After approval of the connection, the trench shall be backfilled as specified.

I. Side Sewer Connections

Where a storm or sanitary side sewer is larger than the trunk, main, or lateral to which it is to be connected, the connection shall be made only at a standard manhole unless otherwise provided in the Drawings or in the Special Provisions, or unless otherwise authorized by the Contracting Officer's Representative.

3.3 BACKFILLING

Placement of pipe zone backfill shall be performed in accordance with these requirements and the Drawings. Trenches shall be backfilled as soon after the pipe laying as possible. Pipe zone backfill material shall be clean earth or sand, free from clay, frozen lumps, roots, or moisture in excess of that permitting required compaction. Rocks or lumps larger than 3 inches maximum shall not be used for pipe zone backfill.

Pipe zone backfill shall be placed in loose layers and compacted to 90 percent maximum density. Backfill shall be brought up simultaneously on each side of the pipe to the top of the pipe zone. The pipe shall then be covered to the top of the pipe zone and the materials compacted in a manner to avoid damaging or disturbing the completed pipe.

Backfill above the pipe zone shall be accomplished in such a manner that the pipe will not be shifted out of position nor damaged by impact or overloading. If pipe is being placed under existing paved areas, or roadways, backfill above the pipe zone shall be placed in

horizontal layers no more than 6 inches thick and compacted to 95 percent maximum density. If pipe is being placed in non-traffic areas, backfill above the pipe zone shall be placed in horizontal layers no more than 6 inches thick and shall be compacted to 85 percent maximum density.

Material excavated from the trench shall be used for backfill above the pipe zone, except that organic material, frozen lumps, wood, rocks, or pavement chunks larger than 6 inches in maximum dimension shall not be used. Materials determined by the Contracting Officer's Representative to be unsuitable for backfill at the time of excavation shall be removed and replaced with imported backfill material.

Backfilling of trenches in the vicinity of catch basins, manholes, or other appurtenances will not be permitted until the cement in the masonry has become thoroughly hardened.

When it is required that a blanket of select material or bank run gravel is to be placed on top of the native backfill, the backfill shall be placed to the elevations shown in the Plans, or to the elevations specified by the Contracting Officer's Representative. Compaction of the native material shall be as required by the Contracting Agency and shall be performed prior to placing the select material. Surface material shall be loosened to whatever depth is required to prevent bridging of the top layer, but shall in no case be less than 18 inches.

The Contractor shall not operate tractors or other heavy equipment over the top of the pipe until the backfill has reached a height of 2 feet above the top of the pipe.

3.4 PLUGGING EXISTING PIPE

Where shown in the Plans or where designated by the Contracting Officer's Representative, existing pipes shall be plugged on the inlet end for a distance of 2 diameters with commercial concrete. Care shall be used in placing the concrete in the pipe to see that the opening of the pipe is completely filled and thoroughly plugged.

3.5 FIELD QUALITY CONTROL

Compaction shall be to the following minimum densities:

a. Pipe bedding: Compacted granular material: 80% of relative density (ASTM D4253 & D4254).
b. Trench backfill: 95% of maximum density (ASTM D4253 & D4254).

Moisture content: All compacted backfill shall be within a minimum of 2% (+/-) of the optimum moisture content of the soil as determined by ASTM D698. Water shall be added to the material, or the material shall be harrowed, disked, bladed, or otherwise worked to ensure uniform moisture content, as specified. Expansive soils may require higher moisture content, as determined through laboratory tests performed by a geotechnical engineer.

END OF SECTION

SECTION 04200

PIPE MATERIALS AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION:
This section specifies pipe material and fittings including coupling bands, joints end sections, protective coatings, hardware and fabrication tolerances.

1.2 RELATED WORK:
A. Section 01300, Submittals
B. Section 01600, Protection of Materials
C. Section 04100, Pipe Installation

1.3 QUALITY ASSURANCE:
A. Pipe material sourcing and selection shall be approved by the Contracting Officer's Representative prior to delivery.
B. The Contracting Officer's Representative shall be notified at least 48 hours in advance of materials delivery to project site.
C. The Contracting Officer's Representative shall be notified at least 48 hours in advance of pipe installation.

1.4 SUBMITTALS:
A. Submit in accordance with Section 01300, Submittals.
B. Submit supplier information and materials data.

PART 2 - PRODUCTS

2.1 DRAIN PIPE

A. PVC Drain Pipe, Couplings, and Fittings

PVC drain pipe, couplings, and fittings shall meet the requirements of AASHTO M 278.

B. Corrugated Polyethylene Drain Pipe, Couplings, and Fittings (Up to 10 Inch)

Corrugated polyethylene drain pipe, couplings, and fittings shall meet the requirements of AASHTO M 252 type C (corrugated both inside and outside) or type S (corrugated outer wall and smooth inner liner). The maximum size pipe shall be 10 inches in diameter.

C. Corrugated Polyethylene Drain Pipe, Couplings, and Fittings (12 Inch Through 60 Inch)

Corrugated polyethylene drain pipe, couplings, and fittings 12 inch through 60 inch diameter maximum, shall meet the minimum requirements of AASHTO M 294 Type S or 12-inch through 24-inch diameter maximum shall meet the minimum requirements of AASHTO M 294 Type C.

2.2 UNDERDRAIN PIPE

A. Perforated PVC underdrain pipe shall meet the requirements of AASHTO M 278. The maximum size pipe shall be 8 inches in diameter.

B. Perforated Corrugated Polyethylene Underdrain Pipe (Up to 10 Inch)

Perforated corrugated polyethylene underdrain pipe shall meet the requirements of AASHTO M 252, Type CP or Type SP. Type CP shall be Type C pipe with Class 2 perforations and Type SP shall be Type S pipe with either Class 1 or Class 2 perforations. Additionally, Class 2 perforations shall be uniformly spaced along the length and circumference of the pipe. The maximum size pipe shall be 10-inch diameter.

C. Perforated Corrugated Polyethylene Underdrain Pipe (12-Inch Through 60-Inch Diameter Maximum), Couplings, and Fittings

Perforated corrugated polyethylene underdrain pipe (12-inch through 60-inch diameter maximum), couplings, and fittings shall meet the requirements of AASHTO M 294 Type CP or Type SP. Type CP shall be Type C pipe with Class 2 perforations and Type SP shall be Type S pipe with either Class 1 or Class 2 perforations. Additionally, Class 2 perforations shall be uniformly spaced along the length and circumference of the pipe.

2.3 CORRUGATED POLYETHYLENE CULVERT PIPE, COUPLINGS, AND FITTINGS

Corrugated polyethylene culvert pipe, couplings, and fittings shall meet the requirements of AASHTO M 294 Type S or D for pipe 12- to 60-inch diameter with silt-tight joints.

Joints for corrugated polyethylene culvert pipe shall be made with either a bell/bell or bell and spigot coupling and shall incorporate the use of a gasket conforming to the requirements of ASTM D 1056, ASTM F 477, or ASTM D 5249. All gaskets shall be factory installed on the coupling or on the pipe by the producer.

Qualification for each producer of corrugated polyethylene culvert pipe requires an approved joint system and a formal quality control plan for each plant proposed for consideration.

A Manufacturer's Certificate of Compliance shall be required and shall accompany the materials delivered to the project. The certificate shall clearly identify production lots for all materials represented. The Contracting Agency may conduct verification tests of pipe stiffness or other properties as it deems appropriate.

2.4 HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

HDPE pipe shall be manufactured from resins meeting the requirements of ASTM D 3350 with a cell classification of 345464C and a Plastic Pipe Institute (PPI) designation of PE 3408. The pipes shall have a minimum standard dimension ratio (SDR) of 32.5.

HDPE pipe shall be joined into a continuous length by an approved joining method. The joints shall not create an increase in the outside diameter of the pipe. The joints shall be fused, snap together, or threaded. The joints shall be watertight, rubber gasketed if applicable, and pressure testable to the requirements of ASTM D 3212. Joints to be welded by butt fusion shall meet the requirements of ASTM F 2620 and the manufacturer's recommendations. Fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure. All field welds shall be made with fusion equipment equipped with a Data Logger. Temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the Quality Control records. Electro fusion may be used for field closures, as necessary. Joint strength shall be equal to or greater than the tensile strength of the pipe.

Fittings shall be manufactured from the same resins and cell classification as the pipe unless specified otherwise in the Drawings or Specifications. Butt fusion fittings and Flanged or Mechanical joint adapters shall have a manufacturing standard of ASTM D 3261. Electro fusion fittings shall have a manufacturing standard of ASTM F 1055.

HDPE pipe to be used as liner pipe shall meet the requirements of AASHTO M 326 and this specification.

The supplier shall furnish a Manufacturer's Certification of Compliance stating that the materials meet the requirements of ASTM D 3350 with the correct cell classification with the physical properties listed above. The supplier shall certify that the dimensions meet the requirements of ASTM F 714 or as indicated in this Specification or the Drawings.

At the time of manufacture, each lot of pipes, liners, and fittings shall be inspected for defects and tested for Elevated Temperature Sustained Pressure in accordance with ASTM F 714. The Contractor shall not install any pipe that is more than 2 years from the date of manufacture. At the time of delivery, the pipe shall be homogeneous throughout, uniform in color, and free of cracks, holes, foreign materials, blisters, or deleterious faults. Pipe shall be marked at 5-foot intervals or less with a coded number that identifies the manufacturer, SDR, size, material, machine, and date on which the pipe was manufactured.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 04300

METAL FABRICATION

PART 1 - GENERAL

A. This specification includes metal fabrications, miscellaneous metal, and related accessory items including, but not limited to, the following:
   1. Steel railings, handrails, brackets, and sockets.
   2. Embedding edge angles in concrete.
   3. Miscellaneous steel framing, supporting angles, plates, brackets, clips, anchors and bolts for equipment and other work which is required to complete the Project.

B. Submittals
   1. Submit under 01300 Submittals.
   2. Product data for each product specified.

C. Quality Assurance and Structural Performance:
   1. Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
   2. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.

PART 2 - PRODUCTS

A. Aluminum alloy products shall conform to the requirements of the applicable ASTM standards listed below. Unless otherwise specified, alloy 6061-T6 shall be used

Product	ASTM Specification
Standard Structural Shape	B308
Extruded Structural Pipe and Tube	B429
Extruded Bars, Rods, Shapes and Tubes	B221
Drawn Seamless Tubes	B210
Rolled or Cold Finished Bars, Rods and Wire	B211
Sheet and Plate	B209

B. Steel Sections: ASTM A992, hot-dip galvanized for exterior use.

C. Steel Pipe: ASTM A53, Type S, Grade B, Schedule 40 typical unless otherwise noted. Steel Tubing: Cold formed, ASTM A500; or hot rolled, ASTM A501; seamless.

D. Stainless Steel: Steel: ASTM A240 for plate or sheet, A269 for tubing and A312 for pipe.
   1. Interior Use: Type 304, 18-8 grade, USS gauge, #4 finish.
   2. Exterior Use: Type 316L, 18-8 grade, USS gauge, #4 finish.

E. Bolts, Nuts, and Washers: ASTM A307. Provide zinc-coated fasteners for exterior use or where built into exterior walls.

F. Drilled Anchors for Use in Concrete: Use anchors with a current ICC evaluation report appropriate to the application.

G. Welding Materials: AWS D1.1; type required for materials being welded.

H. Welding: All surfaces shall be clean, free of rust, paint, and foreign matter of any kind. Burned edges to be welded shall be chipped clean and wire brushed before welding. Clamp members as required, space and alternate welds, as may be necessary to prevent warping or misalignment.

I. Weld Metal: Weld metal shall be thoroughly fused with the base metal along surfaces and edges of the union. Penetration shall be 1/8 inch (4 mm) minimum and shall be into the root of the joint.

J. Weld Quality: Welds shall present a uniform surface, free of imperfections, without undercutting or overlapping, and free from excessive oxides, gas pockets, and nonmetallic inclusions. Welds shall be made with the proper number of beads or passes to secure sound, thoroughly fused joints. Provide backup bars, temporary backup bars, or backup welds for full-penetration butt welds. Each deposit shall not exceed 1/2 inch (12 mm) of weld for each pass of bead. Preceding layers shall be cleaned by wire brushing or preening to remove scale and slag before placing new weld material.

K. Faulty and Defective Welding: Welding showing cracks, slag inclusion, lack of fusion, bad undercut, or other defects ascertained by visual or other means of inspection, shall be chipped out and properly replaced.

L. Cleaning: Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from ferrous metal prior to galvanizing, hot-phosphate treatment, powder coating or painting.

M. Shop Priming: Shop-paint metal work except members or portions of members to be embedded in concrete, surfaces and edges to be field welded, and galvanized surfaces.

N. Galvanizing: Provide a zinc coating for exposed exterior items (unless specified to be powder coated) and items to be embedded in concrete, complying with the following:
   1. For galvanizing iron and steel hardware, ASTM A153.
   2. For galvanizing rolled, pressed, and forged steel shapes, plates, bars, and strips 3mm thick and heavier, ASTM A123.

PART 3 - EXECUTION

A. Fabrication of structural steel shall conform to the requirements of Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, American Institute of Steel Construction.

B. Fabrication of structural aluminum shall conform to the requirements in the Aluminum Design Manual available from The Aluminum Association.

C. Examine the substrate and conditions in which the work is to be installed. Correct unsatisfactory substrate and conditions prior to start of installation.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners for securing metal work to in-place construction, including threaded fasteners for concrete inserts, through bolts, lag bolts, screws, and other connectors as required.
   1. Conceal fastenings where practical. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Form joints exposed to weather to exclude water.

E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of metal work. Set work accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Provide temporary bracing anchors in formwork for items which are to be built into concrete or similar construction.
   1. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch up shop paint coat. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

F. Field Welding: Comply with AWS D1.1 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

G. Corrosion Protection: Protect dissimilar metals from galvanic corrosion by pressure tapes, coating, or isolators as acceptable to Architect-Engineer.

H. Grouting: Do grouting of frames, plates, sills, bolts, and similar items with nonshrink grout.

I. Alignment: Verify alignment of items with adjacent construction. Coordinate related work.

J. Handrails: Secure steel handrails with bracket. Unless otherwise noted, locate brackets 6 inches (150 mm) from ends of handrail, 6 feet (1.8 m) on center maximum, and space brackets equidistant at each handrail.

END OF SECTION

SECTION 05001

CHANNEL AND FLOODPLAIN FILL

PART 1 - GENERAL

1.1 DESCRIPTION:
This section specifies use of native or imported substrate to create stable channels and floodplains, including the sourcing and delivery of rock materials to the staging area. The construction of channel bed features such as streambank toes, engineered riffles, boulder grade controls, and all channel bed features shall comply with this section.

1.2 RELATED WORK:
A. Section 01600, Protection of Materials
B. Section 02200, Earthwork

1.3 QUALITY ASSURANCE:
A. Rock material sourcing and selection shall be approved by the Contracting Officer's Representative prior to delivery.
B. The Contracting Officer's Representative shall be notified at least 48 hours in advance of materials delivery to project site.
C. The Contracting Officer's Representative shall be notified at least 48 hours in advance of streambed placement, at least 48 hours in advance of streambed sealing, and at least 48 hours in advance of boulder placement.

1.4 SUBMITTALS:
A. Submit in accordance with Section 01300, Submittals.
B. Supplier information and Materials Data: Submit the following as one package to the Contracting Officer's Representative:
   1. Rock source, size, description, and gradation.
   2. Rock density and absorption tests results.
   3. Borrow area location(s) for natural gradation materials

1.5 APPLICABLE PUBLICATIONS:
ASTM Method C-127.....Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

PART 2 - PRODUCTS

2.1 ROCK - GENERAL
Individual rock fragments shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering.

The rock shall have the following properties:

a. Bulk specific gravity (saturated surface-dry basis) not less than 2.6.
b. Absorption not more than 2 percent by weight.

2.2 VEGETATIVE FILL - GENERAL

Vegetative fill is fine-grained soil suitable for growing plants. Material suitable for use as vegetative fill shall consist of soils with the loam, sandy loam, clay loam, loamy sand, mucky mineral or muck textures. Vegetative fill shall not include clay, sand, rock or debris.

2.3 ALLUVIUM ROCK

Alluvium rock is primarily natural round river rock, and the origin of the rock material must be alluvial. The least dimension of an individual rock fragment shall be approximately one-third the greatest dimension of the fragment. Alluvium rock is placed below grade and at the surface of the riverbed and floodplain at depths, extents, and grades indicated on the drawings. Alluvium rock gradation used for riverbed, streambank and floodplain fills shall conform to the gradations listed on the Drawings.

2.4 ANGULAR ROCK

Angular rock is primarily small riprap, originating as broken quarry stone or rubble. Individual rock fragments shall be hard, sound, and durable, free from seams, cracks and other defects. For individual rock fragments, the least dimension of any stone shall not be less than 1/3 of its greatest dimension. Angular rock gradations shall conform to gradations listed on the Drawings.

2.4 RIPRAP

Riprap is primarily large angular rock, originating as broken quarry stone or rubble. Individual rock fragments shall be hard, sound, and durable, free from seams, cracks and other defects. For individual rock fragments, the least dimension of any stone shall not be less than 1/3 of its greatest dimension. Riprap gradations shall conform to gradations listed on the Drawings.

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

Materials shall be delivered to the site and stored in a manner that preserves the gradation and identity of each material to be incorporated into the work. The Contracting Officer's Representative will measure and inspect the materials upon delivery to determine compliance with these specifications and the Drawings. Contracting Officer's Representative may reject any or all construction materials that do not satisfactorily meet requirements.

3.2 MIXING

If rocks originate from different sources or different size classes, rock materials of varying gradations and angularity shall be mixed to create mixture specific to that rock type in conformance with rock material gradations identified in the drawings and specifications prior to placement. The mixture should not contain fines smaller than the #200 sieve. Materials shall

be thoroughly mixed to create a homogenous rock mixture prior to placement. Fines shall be kept separate from mixed fill materials.

3.3 PLACEMENT

If rocks originate from different sources or different size classes, rock materials of varying gradations and angularity shall be mixed to create a homogenous mixture prior to placement. Rock material shall be placed by machine in small increments, and released as close to their final position as practical. Rehandling, “raking”, or dragging should be minimized to prevent stone segregation and breakage. For similar reasons, dropping stone materials from excessive height will not be accepted.

END OF SECTION